Iron and Steel ENGINEER

ENGINEERING SERVICE
TO THE IRON AND STEEL
INDUSTRY SINCE 1907

7010 EMPIRE BUILDING TECHNOLOGY DEPT. AUGUST, 1946 PITTSBURGH, PA.

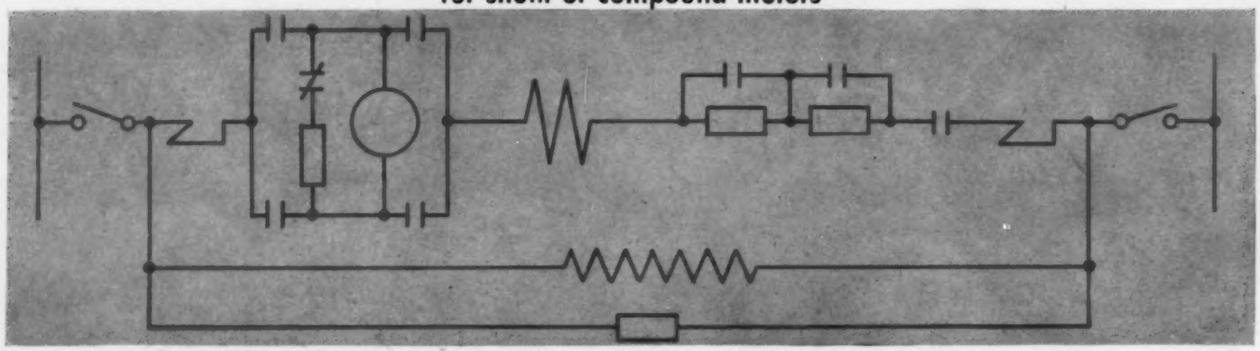
MESTA 56"x51" SPECIAL ALLOY CAST STEEL BACKING UP ROLL FOR A MODERN FOUR-HIGH HIGH SPEED COLD REDUCTION MILL

MESTA MACHINE COMPANY PITTSBURGH, PA.

What control for what mill equipment? One of a SERIES of advertisements featuring basic heavy duty power circuits . . . and showing Cutler-Hammer's broad design and application experience which has made it *the* preferred control for the steel industry.

D. C. reversing dynamic braking control

for shunt or compound motors

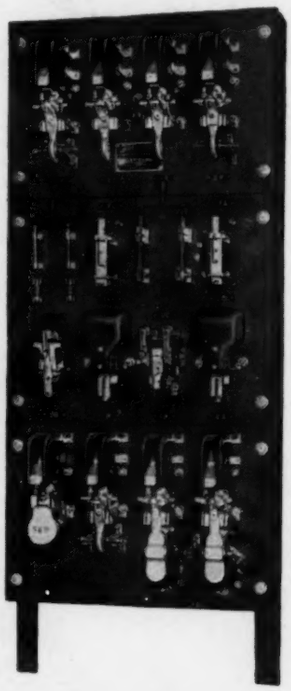


When you have an installation such as a sheet leveler where load and performance characteristics dictate the use of a reversible shunt or compound motor with dynamic braking . . .

Here . . . . call for Cutler-Hammer Control No. 14017

Engineering features . . Cutler-Hammer Bulletin No. 14017 provides smooth, uniform *Ltl* acceleration, simplified dynamic braking and controlled plugging, for quick stop and rapid reversal. Also, when speed control by field weakening is required, Bulletin 14017 provides additional motor protection such as field accelerating, field decelerating, field economizer and field loss relays. It employs dependable constant timing *Ltl* contactors which have a coarse and a micrometer adjustment, not affected by dust and dirt. New type 609 overload relay provides inverse time delay for running protection and instantaneous trip for excessive loads.

CONTROL COMPONENTS . . . Every component in Cutler-Hammer Control is built with extreme ruggedness to provide an unusual margin of reserve. Characteristic of C-H Control construction is its simplicity and the absence of light moving contacts and parts, spring adjustments, etc., that commonly cause trouble.



EQUIPMENT . . . Conforming to NEMA standards. Available in ratings to 1800 amperes. In open, enclosed or complete factory assembled ready to wire units. A complete line of control accessories.

TO A DEGREE perhaps not equalled elsewhere, maintenance in the steel industry is costly because of the consequent loss of time and production. To a degree not equalled elsewhere, "steel" wages unceasing warfare on maintenance, placing highest value on durability and dependability of equipment. And it cannot escape the eye of shrewd production-minded management that it is in "steel". . . in 50 years of "steel". . . that Cutler-Hammer equipment has so largely built its world-wide reputation for dependability.

CUTLER-HAMMER, Inc., 1269 St. Paul Ave., Milwaukee 1, Wis. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto.

CUTLER-HAMMER
MOTOR CONTROL
C-H

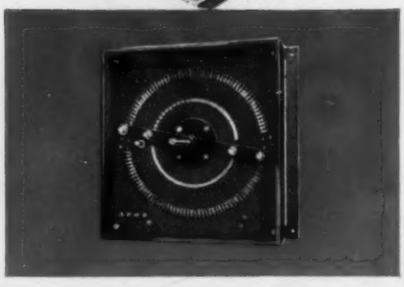
Typical Components of Cutler-Hammer Mill Control

Rotating Cam Limit Switch (cover removed)

Wide range heavy duty uses. Wearing parts oversize. Hardened cam face and roller surfaces. Main shaft ball bearings. Easy, accurate driving shaft adjustment in any position.

Pushbutton Station

Wide range of styles including oil-tight construction. No loops in wiring these large rugged terminals. Oversize mushroom type operating buttons. Drip hoods. Guard flanges.



Field Rheostats

50 or 100 speed points. Manual, chain or motor operated. Renewable brass segments. Rugged long life construction. Single step unit type renewable resistors.

if **YOUR SHEETS LOOK LIKE THIS**

and **YOU WANT THEM LIKE THIS**

LEVELLERS

You want certain features in levellers.

The machines should be able to efficiently handle the sizes, gauges, and kinds of material you want to process. In 2-high and 4-high levellers, Aetna-Standard makes more sizes than any other company.

You want rugged but compact units . . . not space eaters. You require a leveller which will operate day in and day out without time outs every few minutes for adjustments or hours of "down time" for maintenance. As designers and engineers of seamless tube mills, rolling mills, and other mill machinery, Aetna-Standard knows how to design and build efficient machinery with special emphasis on ease of operation and freedom from maintenance.

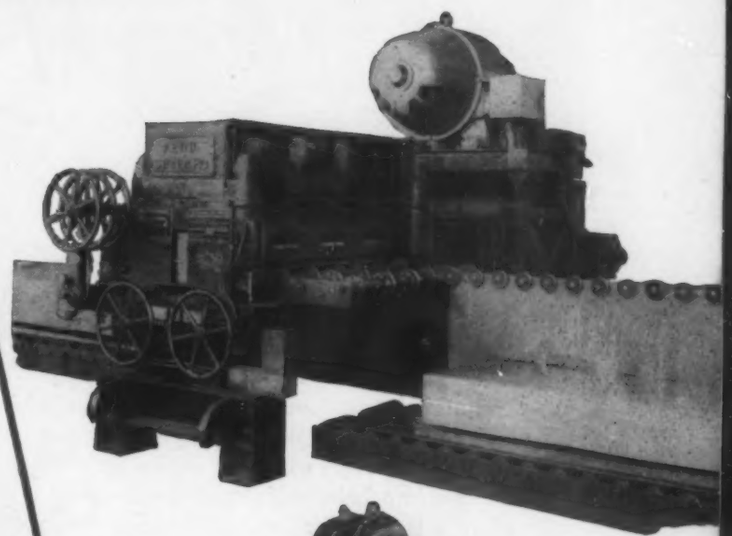
The several hundred Aetna levellers in use today emphasize Aetna-Standard's number one position in the field. **Aetna levellers outperform all competitive production levellers.**

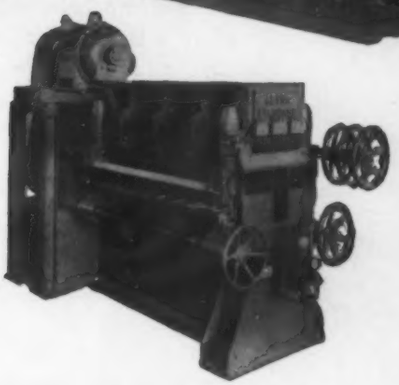
Our designs in all sizes and types of levellers are so complete that leveller orders require little or no engineering. Therefore, your order can be put into production quickly.

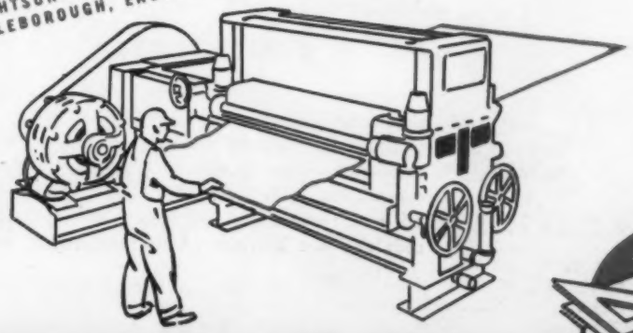
Aetna's field engineers will be glad to recommend proper type of levelling equipment or discuss special requirements. **Call Aetna-Standard for Levellers.**

THE AETNA-STANDARD ENGINEERING CO.
YOUNGSTOWN, OHIO

ASSOCIATED COMPANY
HEAD, WRIGHTSON & COMPANY, LIMITED
MIDDLEBOROUGH, ENGLAND



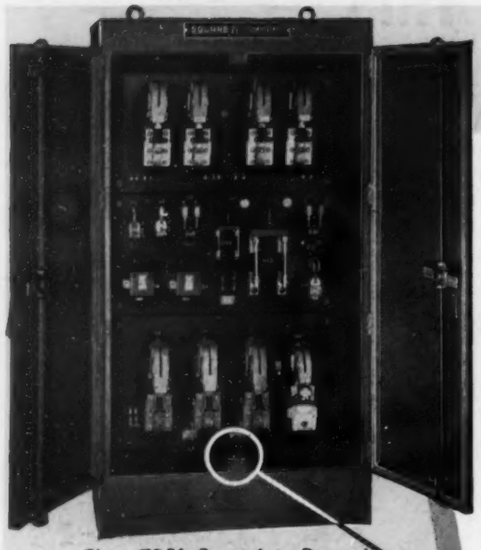




In roller levellers, 2-high and 4-high, the Aetna range extends from rolls of 1¾" dia. x 66" long to rolls of 18" dia. x 140" long . . . including all sizes in between.

DESIGNERS AND BUILDERS to the Steel, Non-Ferrous and Chemical Industries

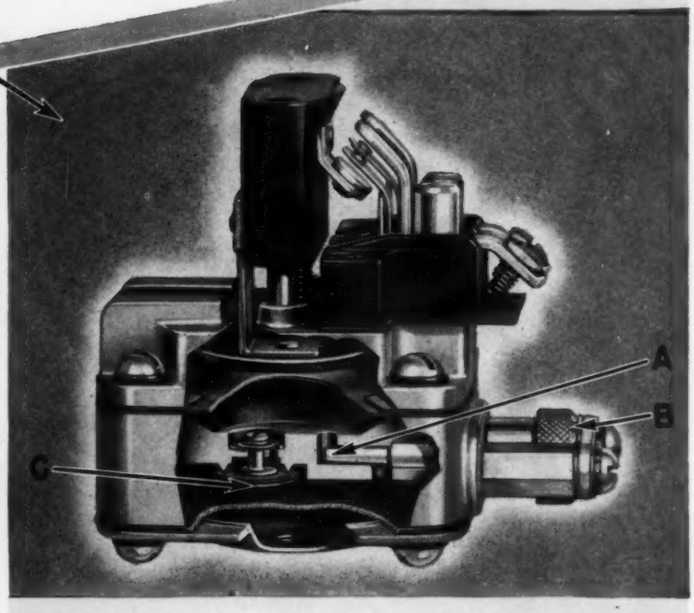
Aetna-Standard



Class 7951 Reversing, Dynamic Braking Control for Mill Auxiliaries

MILL MOTOR *Acceleration* by PNEUMATIC TIMERS

Permits close control of difficult operations—Another reason for specifying Square D Mill Control Panels



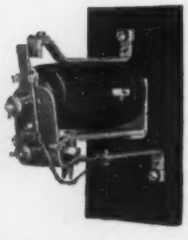
Square D's PNEUMATIC TIMERS provide wide range time limit acceleration unaffected by usual fluctuations in temperature, voltage and other conditions of application. Air is transferred from lower chamber to upper chamber through metering orifice (A). Rotation of knurled wheel (B) gives wide range of adjustment. Air returns through valve (C) for instantaneous reset. Timers may be coupled to contactors or actuated by separate magnets.

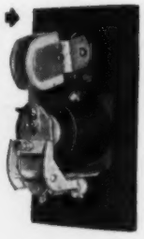
Write for information on the CLASS 7950 SERIES Heavy Duty D. C. Control for cranes and mill auxiliaries and CLASS 9003 Master Switches. Square D Company, 4041 N. Richards St., Milwaukee 12, Wis.

Heavy Duty— CONTROL RELAYS

interconnected with field and armature circuits, timers and master switch contacts, directly influence contactor operation and regulate motor performance. All of similar construction, with knife-edge bearings, 15 amp. silver contacts, strong blowout coils and arc barriers where required.

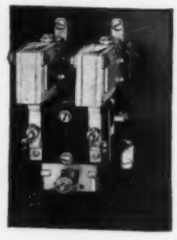
FIELD ACCELERATING

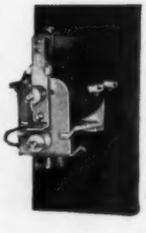




FIELD LOSS

UNDERVOLTAGE RELAY



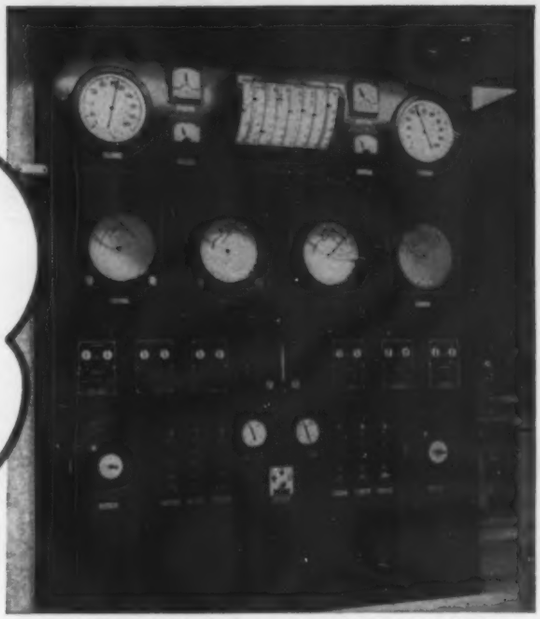


PLUGGING RELAY

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

TIPS ON HOW TO SELECT BOILER CONTROL



Bailey Boiler Control Panel for a 300,000 lb. per hour pulverized coal fired boiler. Both combustion and three-element feed water controls are based on accurate measurements made by meters located on this control panel.

Profit From the Experience of Others

It is likely that plants of the type you are considering are being already operated at optimum performance by Bailey Boiler Control. When you select Bailey Controls, you profit from this experience and get the benefit of the latest refinements in application. Over 8,000 boiler units have been equipped with Bailey Controls during the past 10 years. These units range from 3,000 to 1,000,000 lb. per hour capacity and operate at pressures from 75 to 2500 psi. They are fired by pulverized coal, stokers, oil, gas, mixed fuels and waste fuels.

Call In Qualified Engineers

Bailey Engineers are qualified by training and experience to consult with you on both the theoretical and practical aspects of your boiler control problems. These specialists in combustion, measurement, and automatic controls are conveniently located in over 30 industrial areas throughout the United States and Canada. Your local Bailey Engineer stands ready and willing to apply the Company's know-how to your plant.

Specify a Dependable System

Records indicate that compressed air is a reliable operating medium. Unlike electricity or oil, it continues effective for a time after power failure.

Bailey Boiler Controls are sturdy air-operated units which function in accordance with accurate measurements made by Bailey Meters.

Avoid Make-Shift Applications

The wide selection of both measuring and controlling elements offered by Bailey Meter Company provides complete flexibility of control application. The correct combination of these elements does a thorough job without excessive equipment.

Insure Smooth Operation

Coordination of related control systems such as combustion, feed water, steam temperature, and condensate flow insures against costly disturbances in plant operation. Proper coordination improves control action, increases safety of operation, reduces auxiliary power required and reduces storage capacity needed in heaters and boiler drums.

Be Sure You Can Get Service

Users of Bailey Control have but to call on the nearest branch office of Bailey Meter Company to secure the services of a trained engineer.

For Your Plant

If you want details write for a copy of Bulletin 15-D, or ask a Bailey Engineer to call.

BAILEY METER COMPANY

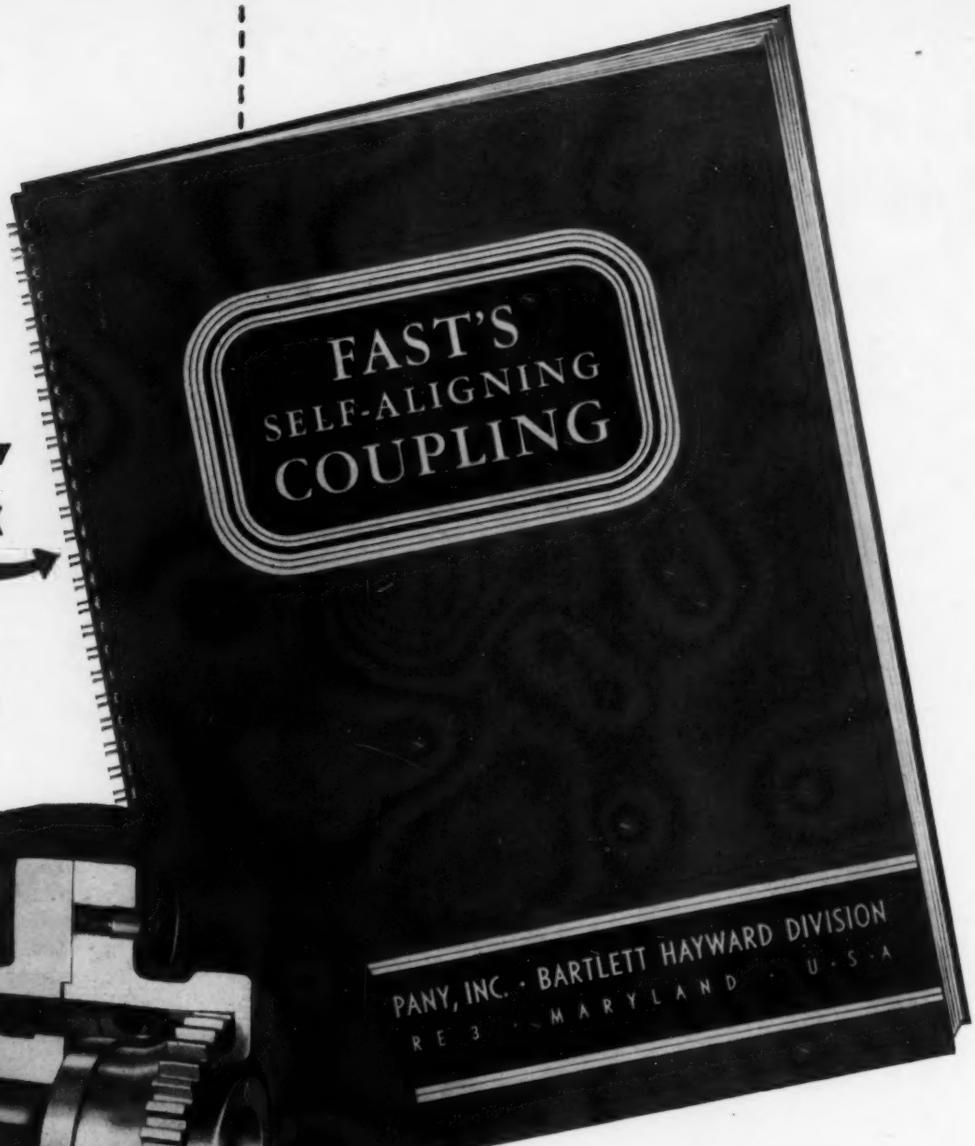
1047 IVANHOE ROAD • • • CLEVELAND 10, OHIO

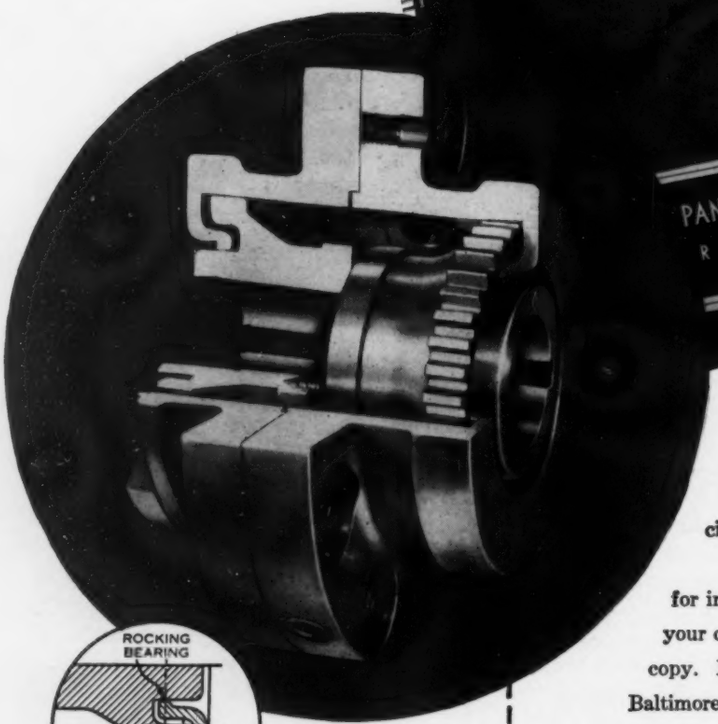
Controls for Steam Plants

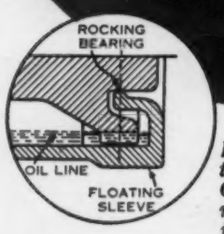
COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS

A97-1

If you use couplings, this book will help you







Here you see the features that give Fast's Couplings their remarkable dependability. All parts are protected from wear by a positive film of oil. Oil purity is guarded by rocking bearings, located in the one position where they maintain a positive metal-to-metal seal. There are no perishable parts in "Fast's."

Here's a book prepared *by* engineers *for* engineers, with a minimum of words and a maximum of facts. Condenses between two covers complete technical data on Fast's Self-aligning Couplings: theory, design, principles of lubrication, types, complete dimensional information, how to figure size, how to order, and instructions for installation and operation. This book will help you solve your coupling problems . . . *for good.* Ask for a complimentary copy. Bartlett Hayward Division, Koppers Company, Inc., Baltimore 3, Maryland.

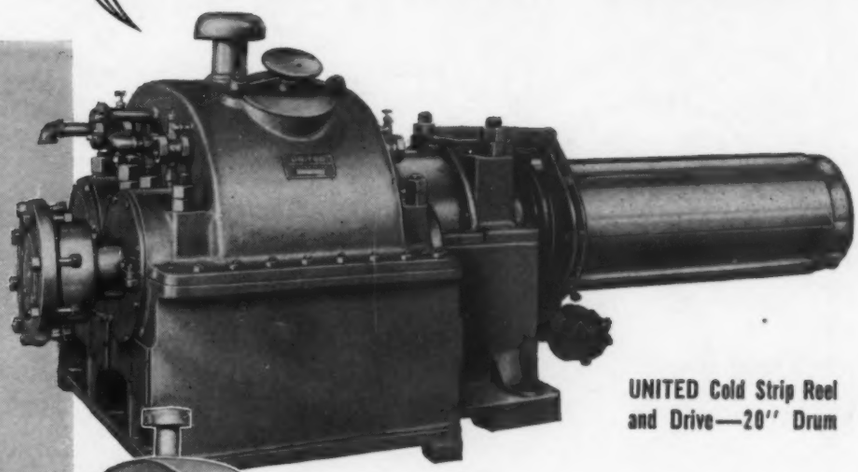
FAST'S *self-aligning* COUPLINGS

SAFEGUARD YOUR POWER TRANSMISSION

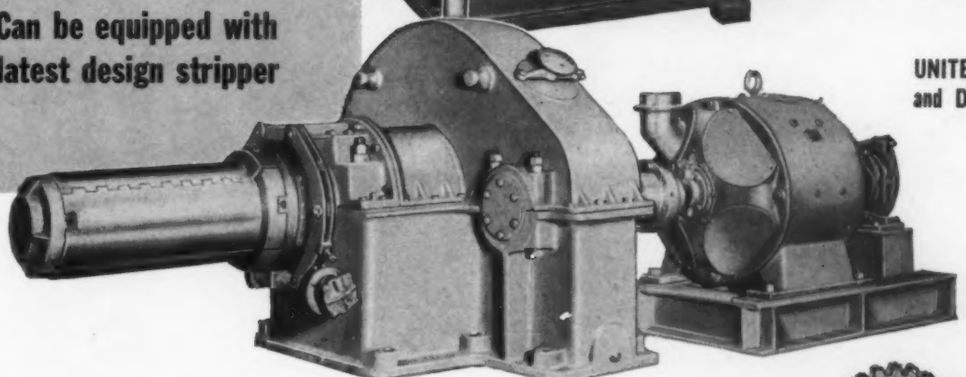
a **KOPPERS** *Product*

UNITED HEAVY-DUTY *Automatic Collapsing* COLD STRIP REELS

- **Simple, rugged construction assures trouble-free service**
- **Dynamically balanced for high speed operation**
- **Can be equipped with latest design stripper**



UNITED Cold Strip Reel and Drive—20" Drum



UNITED Cold Strip Reel and Drive—16" Drum

We design, build and install Cold Strip Reels and auxiliary equipment for every reeling, coiling, winding, blocking, rewinding and uncoiling operation encountered in the handling of cold-rolled metal strip, from flat wires and narrow ribbons to the widest sizes . . . at tensions from 100 pounds to over 100,000 pounds . . . for every commercial metal.

Adaptations of recent modern installations may suit your needs; or our engineers will develop special equipment for unusual requirements.

Why not write us for complete technical data? There is no obligation.

UNITED ENGINEERING and FOUNDRY COMPANY

PITTSBURGH, PA.

Plants at Pittsburgh · Vandergrift · New Castle
Youngstown · Canton

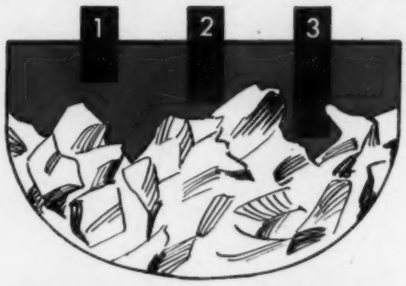
Subsidiary: Adamson United Company, Akron, O.
Affiliates: Davy and United Engineering Company, Ltd., Sheffield, England · Dominion Engineering Works, Ltd., Montreal, P.Q. Canada

The World's Largest Designers and Makers of Rolls and Rolling Mill Equipment

Which of These Arc Furnace Operating Troubles Do You Have?

HERE ARE 6 COMMON DIFFICULTIES — AND HERE'S HOW "REGULEX" CONTROL HELPS YOU CORRECT THEM

MELTDOWN PERIOD

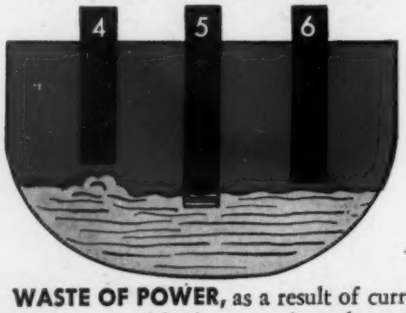


1. REPEATED ARC INTERRUPTIONS, due to sudden "settling" of metal. Sensitive "Regulex" generators reduce arc restrikes by continuous, accurate adjustments.

2. INSTABILITY OF ARC, due to inaccuracy of control for raising electrode when short circuit occurs. "Regulex" variable voltage control raises electrodes *just the right amount* — keeps arc values constant.

3. BREAKAGE OF ELECTRODES, caused by caving in of metal charge against electrodes. Fast-acting "Regulex" control pulls electrodes safely out of a cave-in . . . also conserves electrodes by reducing number of arc restrikes that must be made.

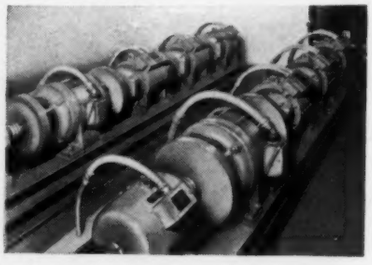
REFINING PERIOD



4. WASTE OF POWER, as a result of current surges when metal boils up against electrodes. "Regulex" variable voltage control raises electrodes with acceleration proportional to deviation of arc current and voltage from normal . . . reduces power input.

5. FREEZING OF ELECTRODES in molten bath, due to electrode "drift" when a-c power fails. Only the "Regulex" generator set is provided with a flywheel for automatically raising electrodes upon a power failure . . . preventing electrode breakage.

6. BURNING OF ELECTRODES during refining period, because of using too short an arc. Accurate "Regulex" control permits use of longer arc — conserves electrodes.



LET ACCURATE "REGULEX" CONTROL SAVE YOU MONEY

EXTRA MELTS—Variable voltage control meets rapidly changing furnace conditions . . . often gives one or more additional melts per day.

LESS POWER WASTE—Elimination of wasteful current surges reduces kilowatt-hour input.

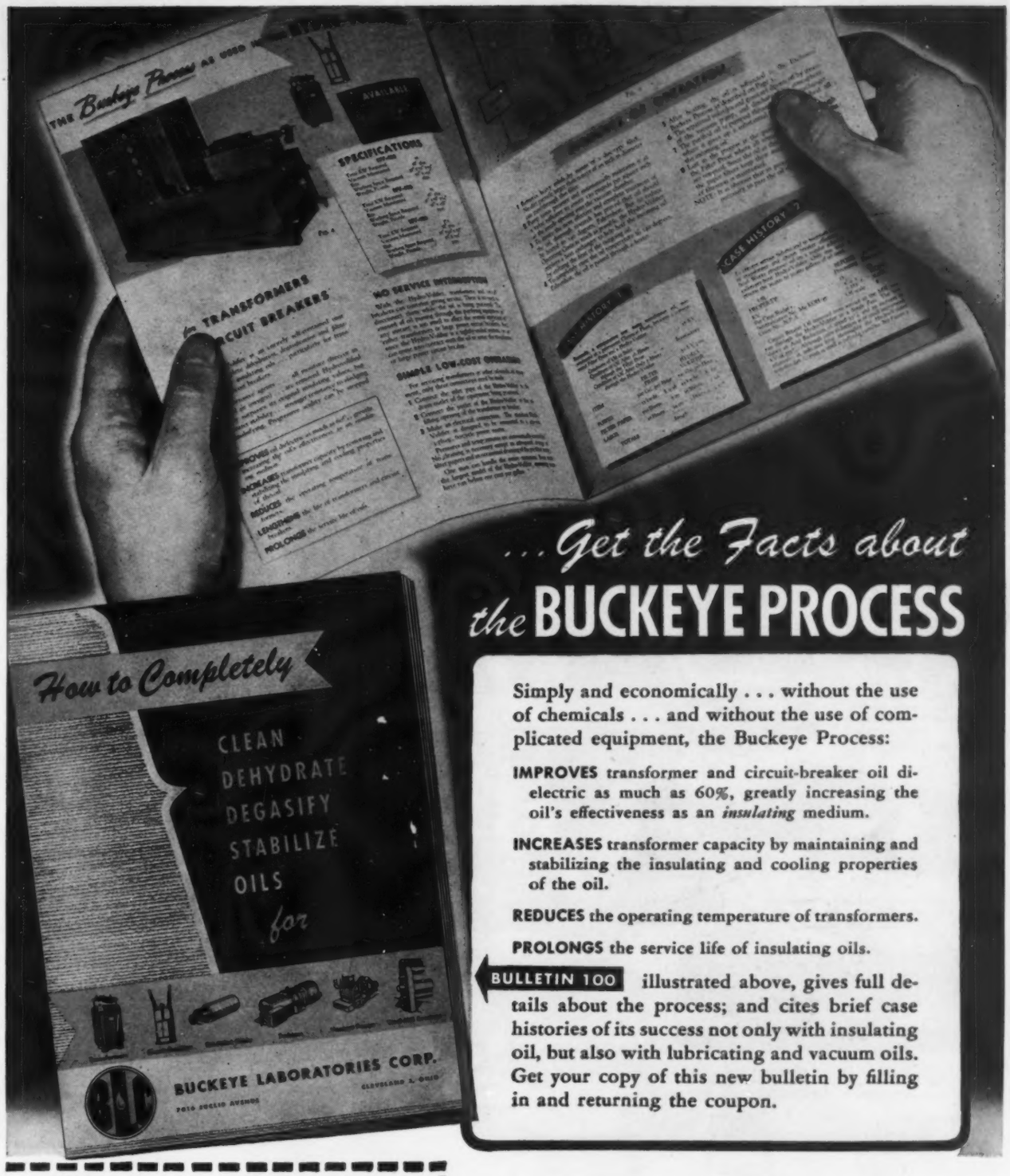
LONGER ELECTRODE LIFE — There's less electrode burning and breakage with quick-acting "Regulex" arc furnace control.

Your arc furnace manufacturer will be glad to tell you about "Regulex" furnace control — or write directly to ALLIS-CHALMERS MFG. CO.

Allis-Chalmers

MILWAUKEE 1, WIS.

A 1938



...Get the Facts about the BUCKEYE PROCESS

Simply and economically . . . without the use of chemicals . . . and without the use of complicated equipment, the Buckeye Process:

IMPROVES transformer and circuit-breaker oil dielectric as much as 60%, greatly increasing the oil's effectiveness as an *insulating* medium.

INCREASES transformer capacity by maintaining and stabilizing the insulating and cooling properties of the oil.

REDUCES the operating temperature of transformers.

PROLONGS the service life of insulating oils.

BULLETIN 100 illustrated above, gives full details about the process; and cites brief case histories of its success not only with insulating oil, but also with lubricating and vacuum oils. Get your copy of this new bulletin by filling in and returning the coupon.

BUCKEYE LABORATORIES CORPORATION
6708 Morgan Ave., Cleveland 4, Ohio

Gentlemen:
Please send me a copy of your new Bulletin 100

Name.....
Company.....
Street.....
City.....State.....

BUCKEYE
LABORATORIES CORP.
6708 Morgan Avenue
Cleveland 4, Ohio

FS and FD Series
CONDULETS

give you an extremely wide choice of interchangeable plain and vaportight covers for **junction boxes, switches, manual motor starters, pilot lights, plug receptacles.**

The illustrations show a representative selection from the 1204 items listed in the FS and FD Section, Condulet Catalog 2500.

(CONDULETS are made only by CROUSE-HINDS)

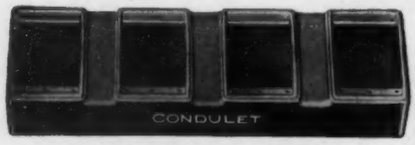
No. 8
of a series of advertisements which demonstrate that CROUSE-HINDS "complete line" means much more than just a range of sizes—there is a wide variety of highly specialized types in each classification.

FS Series. Shallow body, takes wiring devices up to 1 5/8" deep. 16 Types.

FD Series. Deep body, take wiring devices up to 2 1/2" deep. 12 Types.

FS and FD Series Two-Gang. Also available in Three and Four-Gang. 32 Types. Take multiple gang covers.

Type FS with bosses for tapping. Available in One to Three-Gang. Take individual covers.

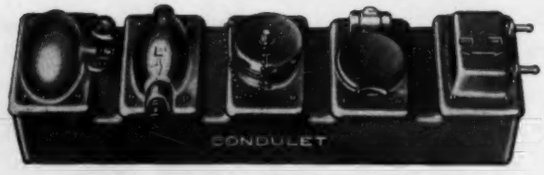


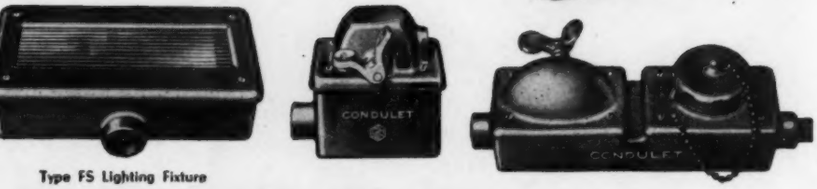
Types FS and FD for any arrangement of welded hubs. Available in One to Five-Gang and Two-Gang Tandem.. Take individual covers.

Type FST Threadless with Tumbler Switch. FS and FD Series Condulets are available with threadless hubs for thick or thin wall conduit.

Type ExF Extensions Available for One to Four-Gang

Type FS Lighting Fixture



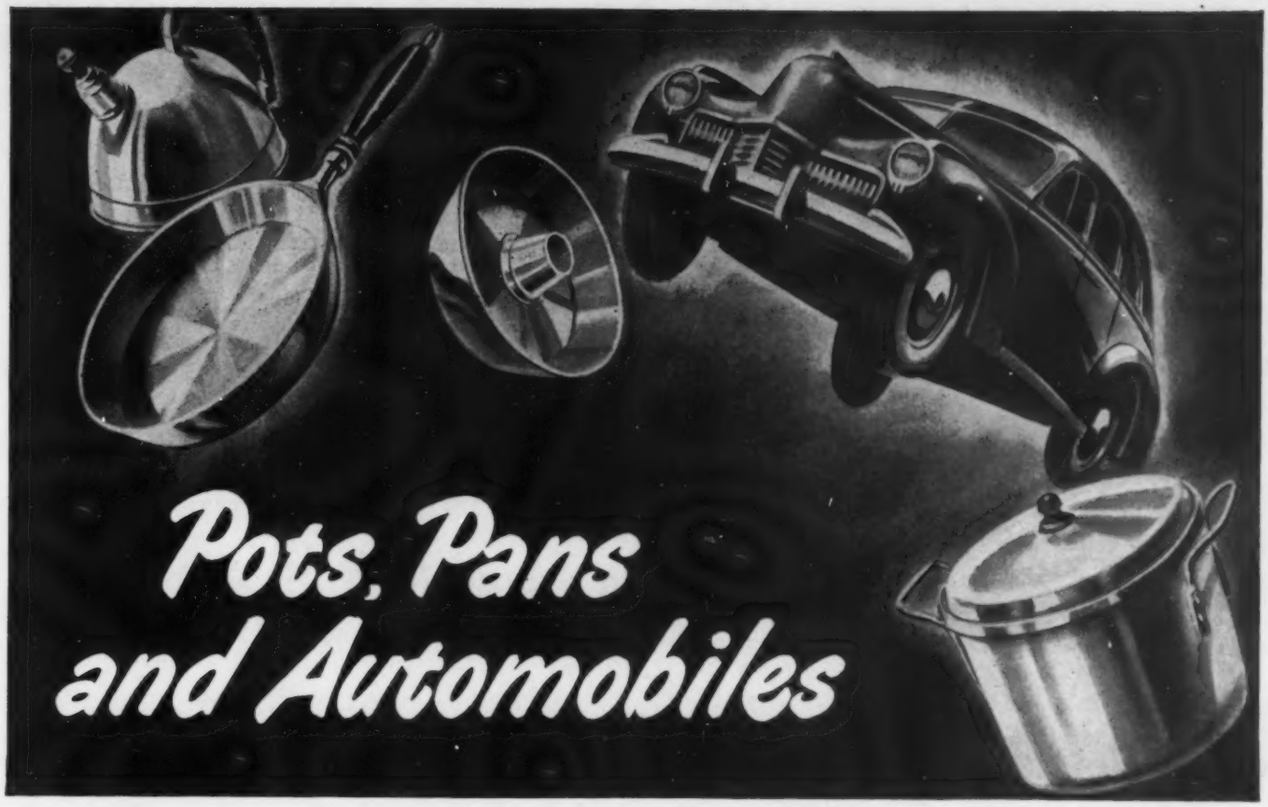


A Nationwide Distribution Through Electrical Wholesalers

CROUSE-HINDS COMPANY
Syracuse 1, N. Y., U.S.A.

Offices: Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit — Houston — Kansas City — Los Angeles — Milwaukee — Minneapolis New York — Philadelphia — Pittsburgh — San Francisco — Seattle — St. Louis — Washington. *Resident Product Engineers:* Albany — Atlanta — Charlotte
CROUSE-HINDS COMPANY OF CANADA, LTD. *Main Office and Plant:* TORONTO, ONT.

CONDULETS · TRAFFIC SIGNALS · AIRPORT LIGHTING · FLOODLIGHTS



A-B-K Laminated Plastic Bearings

Help supply the steel

With an unprecedented demand for civilian goods ahead, the nation's steel mills are called on for volume production. Checks made under peak production conditions prove A-B-K Laminated Plastic Bearings superior to other types of bearings.

★ More tons of steel are rolled per set of A-B-K roll neck bearings because rolls do not require adjustment so frequently. Sheets are rolled to closer tolerances and A-B-K bearings outlast metal bearings.

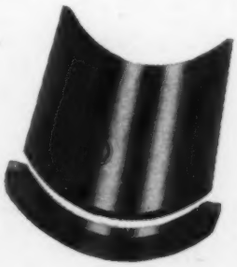
★ Costly delays and shut down periods for bearing replacement are avoided.

★ Power consumption is lowered.

★ Roll Neck lubrication costs are practically eliminated.

A-B-K Laminated Plastic Bearings were designed by American Brakeblok to do the hard jobs. Their record is a success story that speaks for itself.

The same engineering and research facilities which created these bearings are available to help with your steel mill bearing problems. Phone, wire or write, American Brakeblok Division, 4600 Merritt Avenue, Detroit 9, Michigan.



A-B-K Roll Neck Bearing with separate collar.

A-B-K Patented Reinforced Edge Slipper Bearing made to specified blue print sizes.

Phantom view of A-B-K Patented Reinforced Edge Slipper Bearing.

American Brakeblok

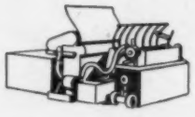
AMERICAN Brake Shoe COMPANY

AMERICAN BRAKEBLOK DIVISION
DETROIT 9, MICHIGAN

WHEN

YOU'RE FIGURING FUEL-COST-PER-TON — FINISHED AND SHIPPED

YOU CAN'T AFFORD DOWN-TIME FOR POT REPAIR



YOU WANT THE WORK AND THE PROCESS (NOT THE FIRING) TO FIX POT SHAPE

THEN

the logic of KEMP tin and lead melting shows up

FUEL costs, for melting, as in dip tinning or lead patenting, are no small factor in the ultimate cost-per-ton of product. Therefore, the opportunity to cut them 30 to 40% by more efficient firing is something to think about.

It's not at all unusual for a switch to KEMP immersion-firing to save that much—because the heat (all of it) is liberated right in the molten metal, not outside the pot. And none is lost to the setting except by flow through the work.

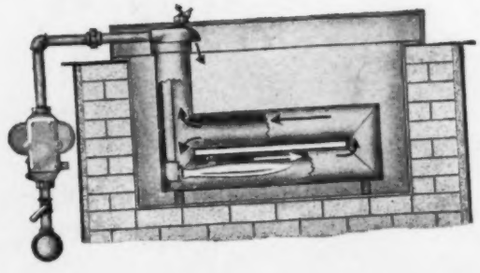
By the same token, pot wall temperatures are lower (from the molten metal temperature *down*)—and more uniform! That's why you enjoy longer pot life with less down-time for maintenance and repair.

And KEMP immersion-firing loops can be of any shape you wish. They can be located in the bath where most convenient to your work and your process. You have full freedom in specifying the setting style you want.

There are 29 years of experience in carbureted-combustion and immersion-melting behind the coupon in the corner. Use it.

WITH MODERN IMMERSION-FIRING YOU HEAT THE METAL—NOT THE POT

Combustion is within tubular loops totally immersed in the metal. Recirculation of hot combustion gases around each loop (driven by the force of the burner flame) promotes efficiency and uniformity of temperature over the loop surface. When the hot gases do exhaust, they vent down over the molten metal surface, reducing heat losses from the system, and minimizing dross. Standard designs have metal capacities from 2 to 20 tons—special sizes and shapes, and larger capacities, quoted on request.



KEMP OF BALTIMORE

PRECISION CARBURETION + ADAPTED COMBUSTION
FOR INDUSTRY'S HEAT-USING PROCESSES
ATMOSPHERE GENERATION & ADSORPTIVE DRYER SYSTEMS
FOR PROCESS CONTROL AND PROTECTION

JMLco K-H: 8

The C. M. Kemp Mfg. Co.
204 E. Oliver Street, Baltimore 2, Md.

Have a field-engineer come look at our soft-metal melting setup. We want to save 30 to 40% in fuel cost ..... ☐

NAME_____

TITLE_____

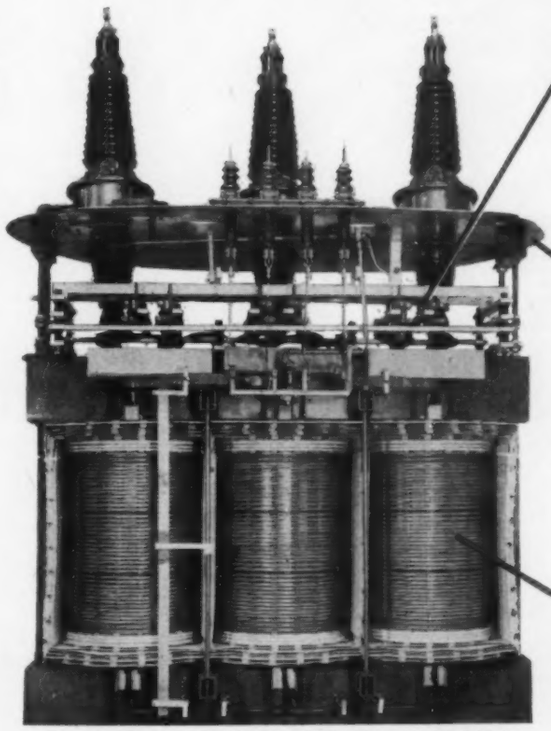
COMPANY_____

PLACE_____

inside a Pennsylvania Transformer

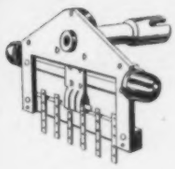
60 seconds devoted to the study of the interior assembly of this transformer will disclose four salient features that are engineered into every High Voltage Pennsylvania Power Transformer.

The Engineering and Design principles described below are some of the reasons why every day, more and more Industries and Utilities are specifying Pennsylvania Power Transformers.



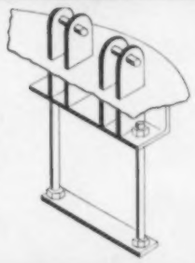
15000 KVA, 115 KV, 3 PHASE, 60 CYCLES

STRAIGHT-LINE TAP CHANGER WITH SILVER-TO-SILVER CONTACTS



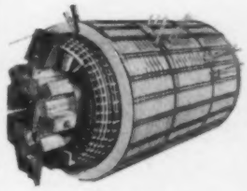
Pennsylvania's Straight-Line Tap Changer with its silver-to-silver contacts is capable of carrying heavy overloads without overheating and is able to withstand "dead" short circuits without detrimental effects. Silver contacts never freeze in position.

CORE, COILS AND COVER UNTANK AS A UNIT



Two sets of bars with lifting pins are welded to each side of the cover and to an angle frame beneath the cover. Rods connecting this frame to the core and coil assembly permit the core, coils and cover to be lifted as a unit.

CIRCULAR COILS POSSESS MAXIMUM INHERENT STRENGTH



Circular coils are balanced radially and axially against short circuit stresses. The turns in a circular coil are wound tightly without excessive tension on the wire. This eliminates the possibility of stretching the winding and injuring the insulation.

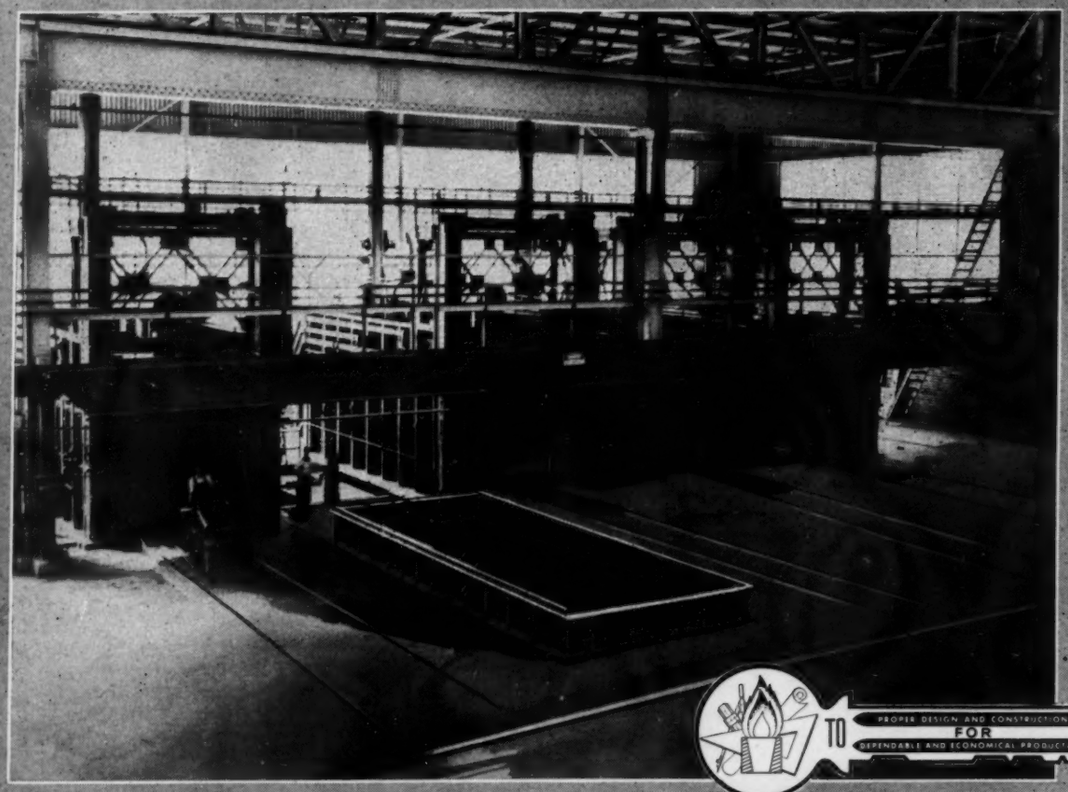
COILS PRECOMPRESSED TO WITHSTAND SHORT CIRCUITS

All helical and pancake coils are precompressed under pressures greater than short circuit stresses encountered in service. The ability of the coils to maintain their shapes under the prescribed pressures definitely guarantees that the transformers will withstand short circuits.

Pennsylvania TRANSFORMERS

Pennsylvania TRANSFORMER COMPANY
PITTSBURGH, PENNSYLVANIA

Car-Type Furnaces
With Quench Tank



By LOFTUS

Tailor-Made Industrial Furnaces for economical performance, longer campaigns and greater production.

Modern design and sound construction of these Car Type Furnaces with Quench Tank assure first quality annealing for carbon and alloy steels.

The two furnaces on the left of picture are over and underfired, and equipped for recirculation of the hot gases. These furnaces provide for a uniform, controlled heat-treating campaign.

The Car Type Furnaces on the right are over and underfired, but do not have the Recirculating System.

Loftus Engineers are prepared to design and construct any type Industrial Furnace to meet your requirements.

Consultation invited

Consultants, Engineers and Contractors for the Steel, Foundry, Aluminum and Brass Industries.

610 SMITHFIELD ST. **LOFTUS ENGINEERING** *corporation* PITTSBURGH, PA.

Designers and Builders Engineers, Consultants, Contractors

POOLE

A COPY OF CATALOG GIVING FULL DESCRIPTION AND ENGINEERING DATA SENT UPON REQUEST.

FLEXIBLE COUPLINGS

POOLE FOUNDRY & MACHINE COMPANY

WOODBERRY, BALTIMORE, MD.

"LEAD SITUATION BECOMING PROGRESSIVELY WORSE"

Lead-Covered Cable to Remain in Short Supply

According to a recent report of the Civilian Production Administration "the lead situation is becoming progressively worse . . . it is feared that the inability to obtain lead will result in curtailment of production by lead consuming industries such as the battery, chemicals and cable covering industries."

...but Okonite has time-tried answers

Among today's Okonite-introduced cable developments are, fortunately, a number that do the job of lead-covered cables as well as—and in some cases—better than those long scarce items. Here are several suggestions for removing the handicaps of today's shortages. Among them you may find more than one answer: Write for Bulletins to The Okonite Company, Passaic, N.J.

FOR LOW VOLTAGES (0-5000 volts) . . .
use OKOLITE-OKOPRENE* CABLES

Okolite-insulated conductors are protected by a sheath of Okoprene, an Okonite-designed neoprene compound. No braids to rot or disintegrate. Resist moisture, ozone, sunlight, oil, chemicals and flame. Flexible. Long-lived. Tough air-tight covering provides permanent seal. High surface resistance. Surface discharge eliminated. No lead wipes or potheads. No expert splicers needed. Recommended for apparatus leads, networks, power, light and signal circuits. Millions of feet in service. Bulletin OK-2009-E.

*U.S. Pat. No. 2,312,058

FOR HIGHER VOLTAGES (To 38,000 volts) . . .
use the same OKOLITE INSULATION WITHOUT A LEAD COVERING

with Okoprene or other finishes for direct burial or in ducts. Also for submarine cables and dredge cables, and in other completely-immersed circuits. 20-year service record. Excellent moisture, heat and ozone resistance. Low specific inductive capacity and power factor. Eliminates electrolysis. Simplifies splicing and terminating. Reduces terminating costs. Bulletin OK-2007-D.

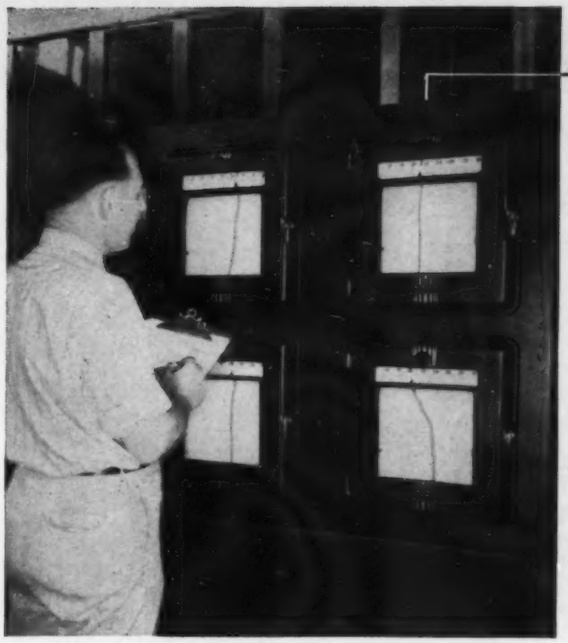
FOR HIGH VOLTAGES (Up To 230,000 volts) . . .
use
OILOSTATIC TRANSMISSION SYSTEMS

with oil-impregnated paper-insulated conductors in welded steel pipe filled with oil under 200 lbs. pressure. Higher dielectric strength. Greater insulation stability. Increased current carrying capacity. Right of way costs radically reduced. Proved in past 14 years. Over 20 separate circuits in operation. Improves property values by eliminating overhead lines. Saves space in generating stations. Bulletin OK-2019-A.

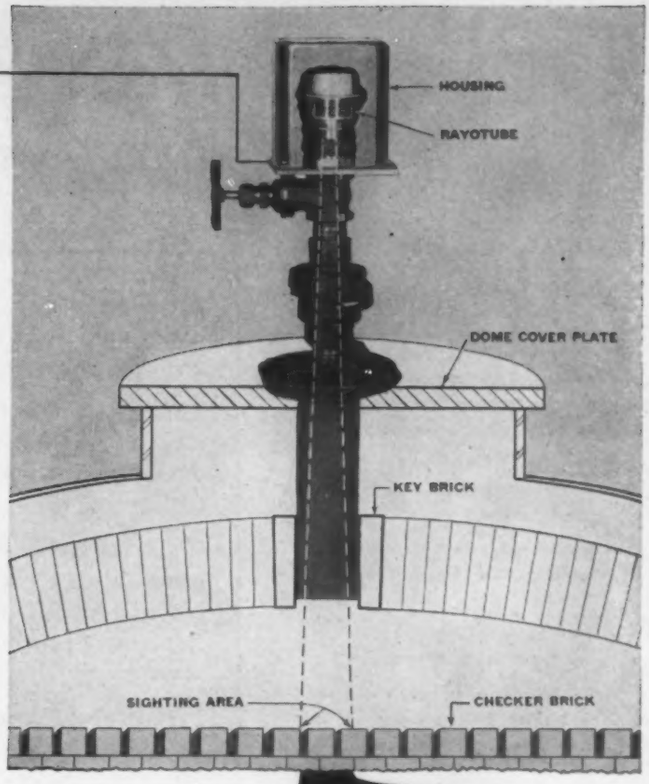
FOR STREET AND AIRPORT LIGHTING, UNDERGROUND BUILDING ENTRANCES . . .
use HAZARD ARMORTITE CABLE

non-metallic underground cable with protective coverings of asphalted jute, leather-like armor tape, plastic sealing compound and rubber-faced tape. Not affected by moisture, acids or alkalies. Introduced in 1928, has served nearly two decades without insulation failure. Can be buried directly in ground. Mechanically strong. Requires no conduit. Bulletin 146.

OKONITE SINCE 1878 **insulated wires and cables**



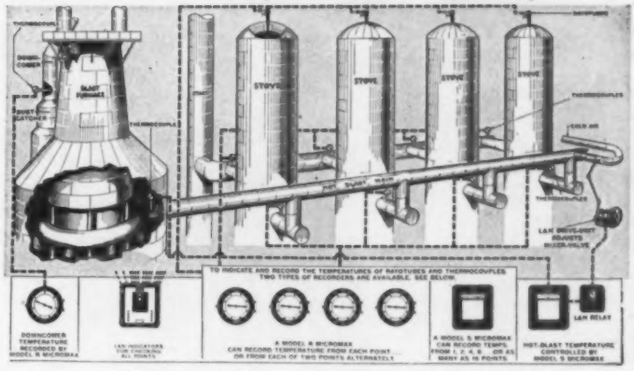
This omparatively new way of measuring stove temperatures is a definite help to higher efficiency. Above photo is not in a steel mill. but does show one of the popular types of Micromax Recorder for steel mill service.



STOVE-DOME TEMPERATURES

ARE EASIER TO CONTROL

IN THIS RAYOTUBE WAY



Several dozen sets of blast-furnace stoves are now being temperature-controlled by means of Micromax Pyrometers with Rayotubes, instead of thermocouples, as their temperature-detecting units. Rayotubes, in the mounting designed especially for stove domes, have various advantages:

1. It's definitely easier to operate the stoves at full efficiency. When thermocouples are used as detectors, the temperature recorded is that of the blast gas. Rayotubes, however, give the temperature of the checker-brick surfaces, and it is of course this temperature which governs the stove's operation. Guided by brick temperature, the operators can prevent fusing of ash and damage to checkers, yet can run the stoves safely at maximum heat capacity.

2. Maintenance of Rayotubes is only a small fraction of that required by thermocouples, because Rayotubes should never burn out. The hot, corrosive blast gas does not reach the temperature-sensitive element, and only normal routine care is required, both for Rayotube and Micromax Recorder.

Catalog N-33B describes Micromax Rayotube Pyrometers in general, and will be sent on request. If you have a specific problem, an L&N engineer will be glad to send or bring more specific information.

LEEDS & NORTHRUP COMPANY, 4942 STENTON AVE., PHILA. 44, PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

Jrl Ad N-33B-642(2)

Keying FURNACE PERFORMANCE *to new production* OBJECTIVES

F. E. I. EQUIPMENT

Direct-Fired Cover Furnaces for annealing, spheroidizing, Normalizing and Bright annealing of wire, rods, coiled strip, flat sheets and tin plate.

For Heavy Coil Loads: Patented Convection Base, gives 2 to 4 times longer service.

For Wire, Bar and Tube Mills: Galvanizing, Patenting and Normalizing Furnaces.

For Pipe, Sheet, and Job Plants: Hot Dip Galvanizing Furnaces.

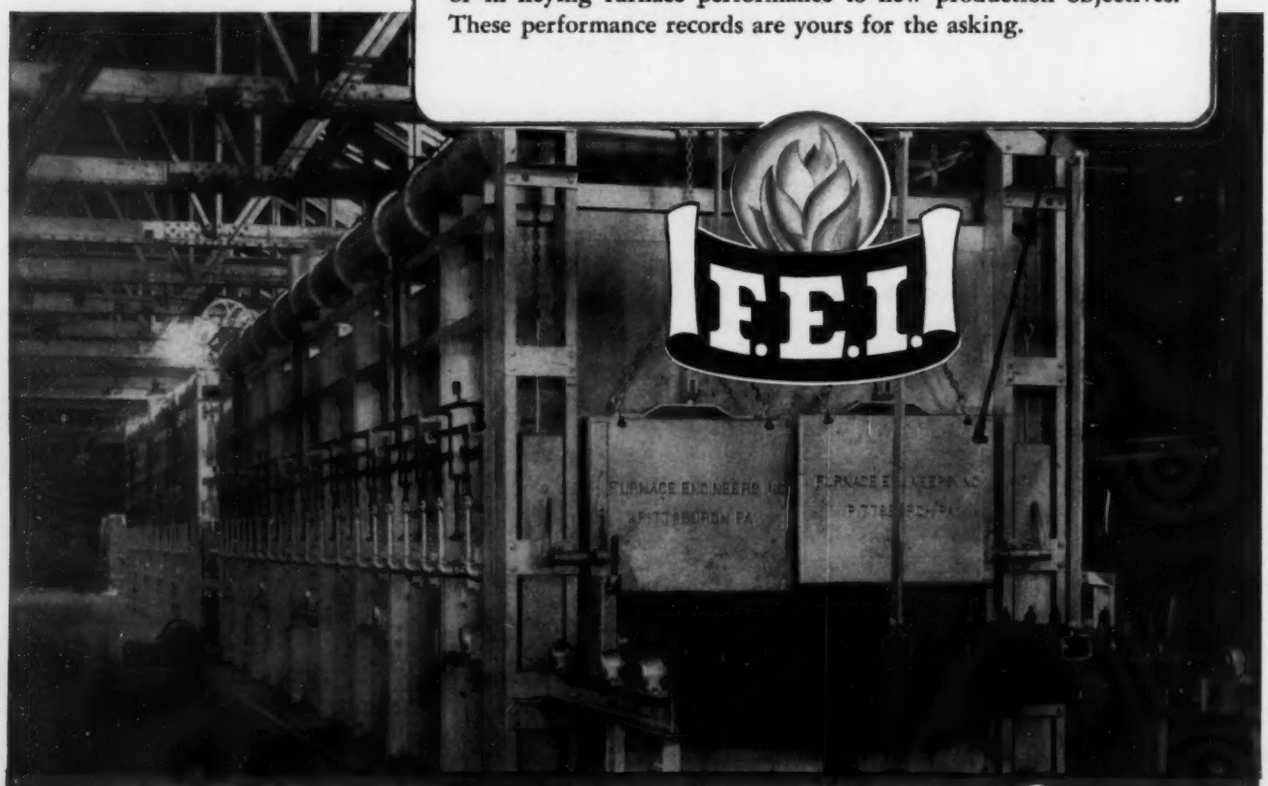
Car Type Furnaces, Rod Heating, Lead Quenching, Ladle Heating and Salt Bath Descaling Furnaces.

Broadly speaking, no part of mill equipment today offers greater opportunities for reducing operating troubles, improving quality and reducing cost, than does furnace equipment.

This is so partly because of difficulties inherent in the subject itself and partly because in equipping new or old mills, the fact is too frequently overlooked that heating furnaces are production tools second to none in affecting quality, quantity and cost of output.

There is a third, an even more important reason: Notable improvements in furnace design made in recent years, in which F. E. I. have played a leading part. These advances already have proved of great importance to iron and steel mills in tonnage production of rods, wire, coiled strip, flat sheets, tin plate and shapes.

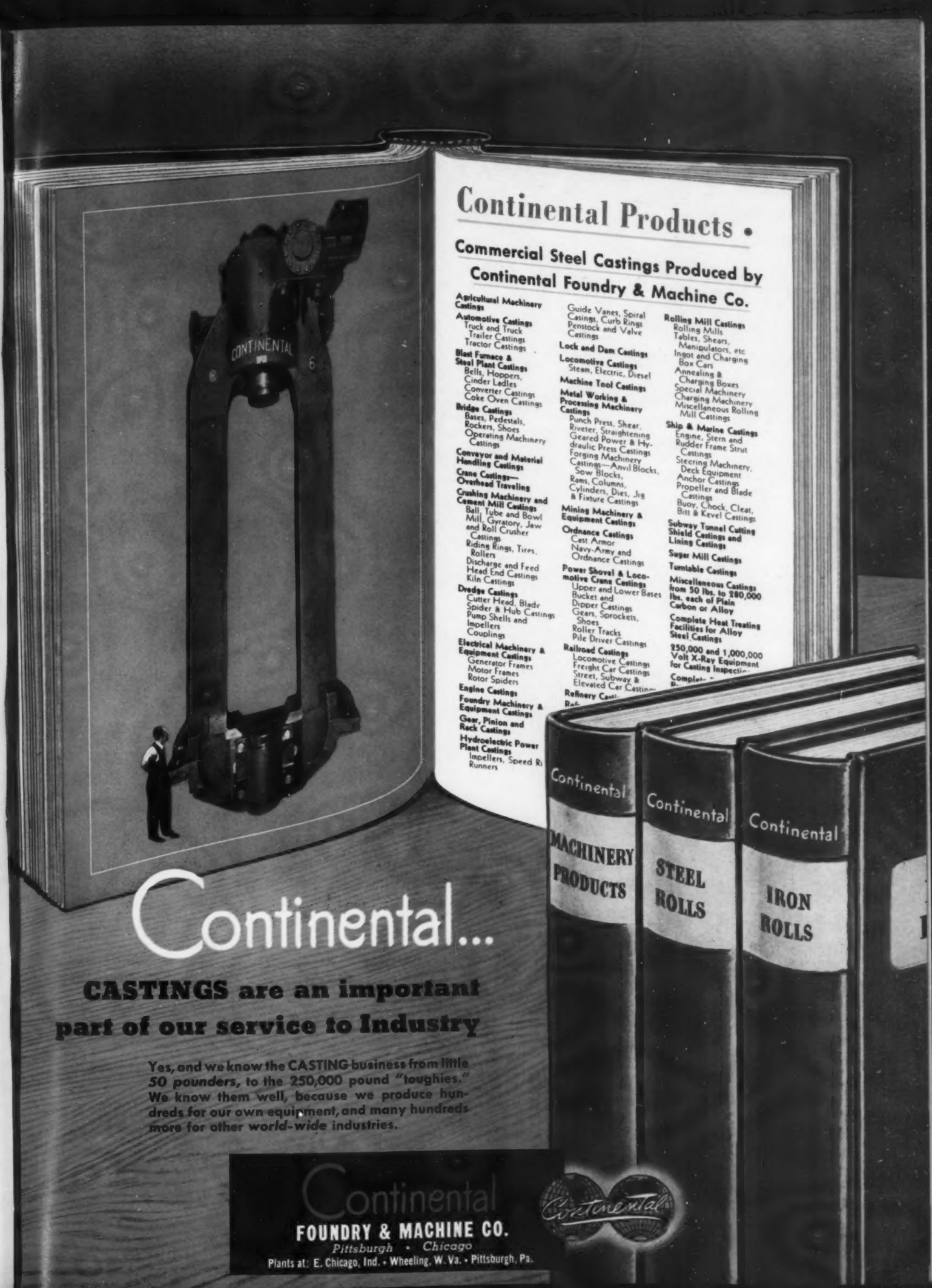
Performance Records on the latest and most advanced types of F.E.I.-engineered equipment is especially valuable to production men interested in obtaining better results from their old equipment, or in keying furnace performance to new production objectives. These performance records are yours for the asking.



FURNACE ENGINEERS, *Inc.*

Foreign Representatives { FOR CANADA: Salem Engineering (Canada) Ltd. Toronto, Ont.
FOR EUROPE, ASIA, AFRICA: Salem Engineering Co. Ltd., Milford, Nr. Derbey, England.

1551 WEST LIBERTY AVENUE ★ PITTSBURGH, PA.


CONTINENTAL
Continental Products •
Commercial Steel Castings Produced by
Continental Foundry & Machine Co.
Agricultural Machinery Castings
Automotive Castings
Truck and Truck Trailer Castings
Tractor Castings
Blast Furnace & Steel Plant Castings
Bells, Hoppers, Cinder Ladles
Converter Castings
Coke Oven Castings
Bridge Castings
Bases, Pedestals, Rockers, Shoes
Operating Machinery Castings
Conveyor and Material Handling Castings
Crane Castings—Overhead Traveling
Crushing Machinery and Cement Mill Castings
Ball, Tube and Bowl Mill, Gyratory, Jaw and Roll Crusher Castings
Riding Rings, Tires, Rollers
Discharge and Feed Head End Castings
Kiln Castings
Dredge Castings
Cutter Head, Blade Spider & Hub Castings
Pump Shells and Impellers
Couplings
Electrical Machinery & Equipment Castings
Generator Frames
Motor Frames
Rotor Spiders
Engine Castings
Foundry Machinery & Equipment Castings
Gear, Pinion and Rack Castings
Hydroelectric Power Plant Castings
Impellers, Speed Ri
Runners
Guide Vanes, Spiral Casings, Curb Rings
Penstock and Valve Castings
Lock and Dam Castings
Locomotive Castings
Steam, Electric, Diesel
Machine Tool Castings
Metal Working & Processing Machinery Castings
Punch Press, Shear, Riveter, Straightening
Geared Power & Hydraulic Press Castings
Forging Machinery Castings—Anvil Blocks, Saw Blocks, Rams, Columns, Cylinders, Dies, Jig & Fixture Castings
Mining Machinery & Equipment Castings
Ordnance Castings
Cast Armor
Navy-Army and Ordnance Castings
Power Shovel & Locomotive Crane Castings
Upper and Lower Bases
Bucket and Dipper Castings
Gears, Sprockets, Shoes
Roller Tracks
Pile Driver Castings
Railroad Castings
Locomotive Castings
Freight Car Castings
Street, Subway & Elevated Car Castings
Refinery Cast
Ref
Rolling Mill Castings
Rolling Mills
Tables, Shears, Manipulators, etc
Ingot and Charging Box Cars
Annealing & Charging Boxes
Special Machinery
Charging Machinery
Miscellaneous Rolling Mill Castings
Ship & Marine Castings
Engine, Stern and Rudder Frame Strut Castings
Steering Machinery, Deck Equipment
Anchor Castings
Propeller and Blade Castings
Buoy, Chock, Cleat, Bitt & Kevel Castings
Subway Tunnel Cutting Shield Castings and Lining Castings
Sugar Mill Castings
Turntable Castings
Miscellaneous Castings from 50 lbs. to 280,000 lbs. each of Plain Carbon or Alloy
Complete Heat Treating Facilities for Alloy Steel Castings
250,000 and 1,000,000 Volt X-Ray Equipment for Casting Inspectio
Complet
P
Continental
MACHINERY PRODUCTS
Continental
STEEL ROLLS
Continental
IRON ROLLS
Continental...
CASTINGS are an important part of our service to Industry
Yes, and we know the CASTING business from little 50 pounders, to the 250,000 pound "toughies." We know them well, because we produce hundreds for our own equipment, and many hundreds more for other world-wide industries.
Continental
FOUNDRY & MACHINE CO.
Pittsburgh • Chicago
Plants at: E. Chicago, Ind. • Wheeling, W. Va. • Pittsburgh, Pa.
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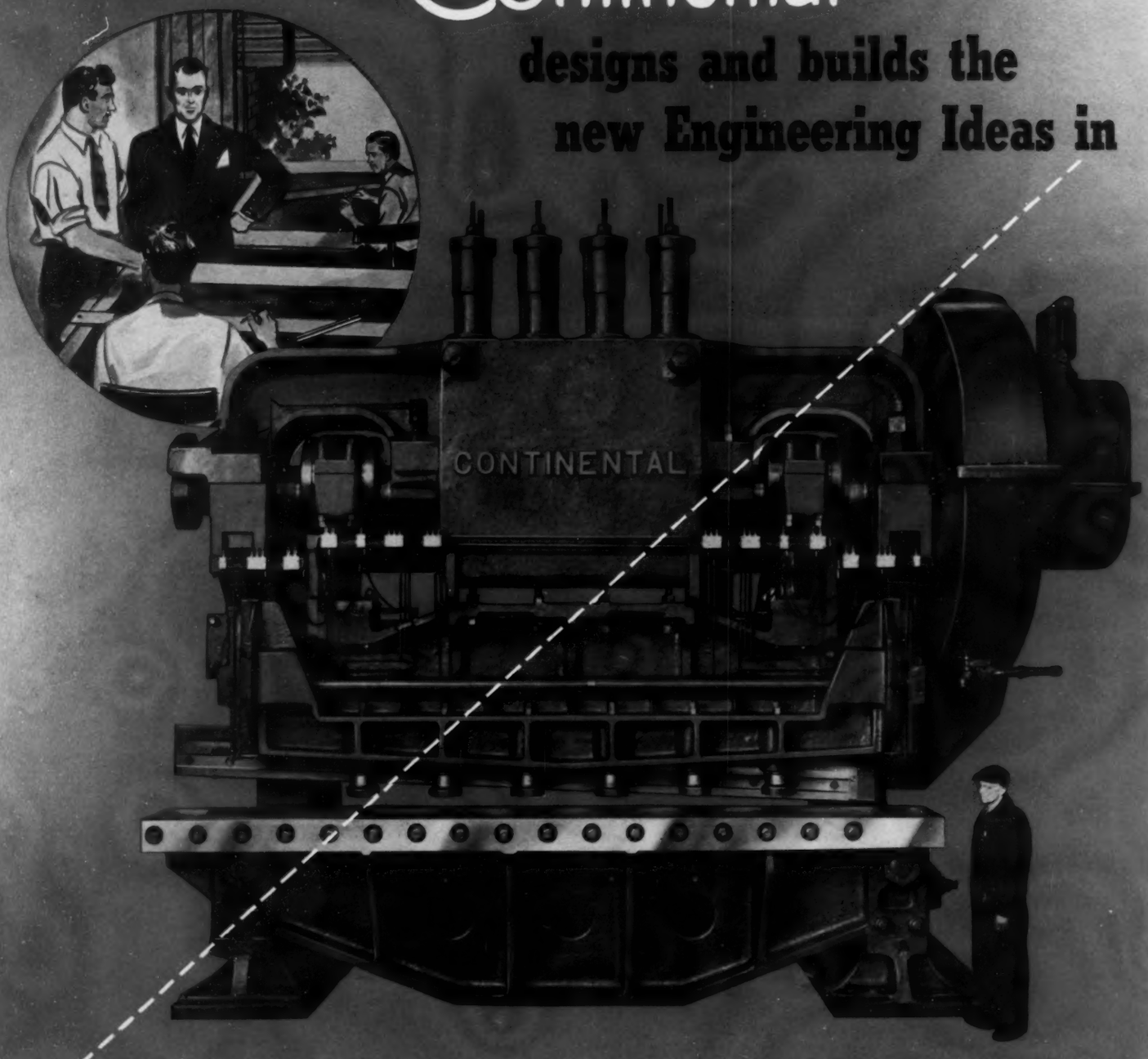
designs and builds the new Engineering Ideas in



Metal Producing, Metal Handling Machinery and Equipment

Need a special type of equipment,—to do an unusual job,—using a new metal or alloy—for a new product—for lower labor or production costs? CONTINENTAL engineers can provide the experience, knowledge and aid for the successful solution of these problems —*quickly*—let them work with you now.

Continental

FOUNDRY & MACHINE CO.

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WRAP WITH Fibron PLASTIC TAPE

Transparent Fibron Plastic Tape permits ready inspection.
Plastic gaskets also available.

IRVINGTON
Varnish and Insulator Company
Irvington 11, New Jersey, U.S.A.

Whenever equipment wiring must withstand severe operating conditions, attacks from moisture, oils, and chemical fumes as well as mechanical abuse, wrap harnesses and leads with protective Fibron Plastic Tape. This black or transparent tape is tough, remains flexible at low temperatures, and has good insulating properties.

Extremely elastic, Fibron Plastic Tape wraps smoothly and evenly over irregular surfaces and will not bulk in sharp corners.

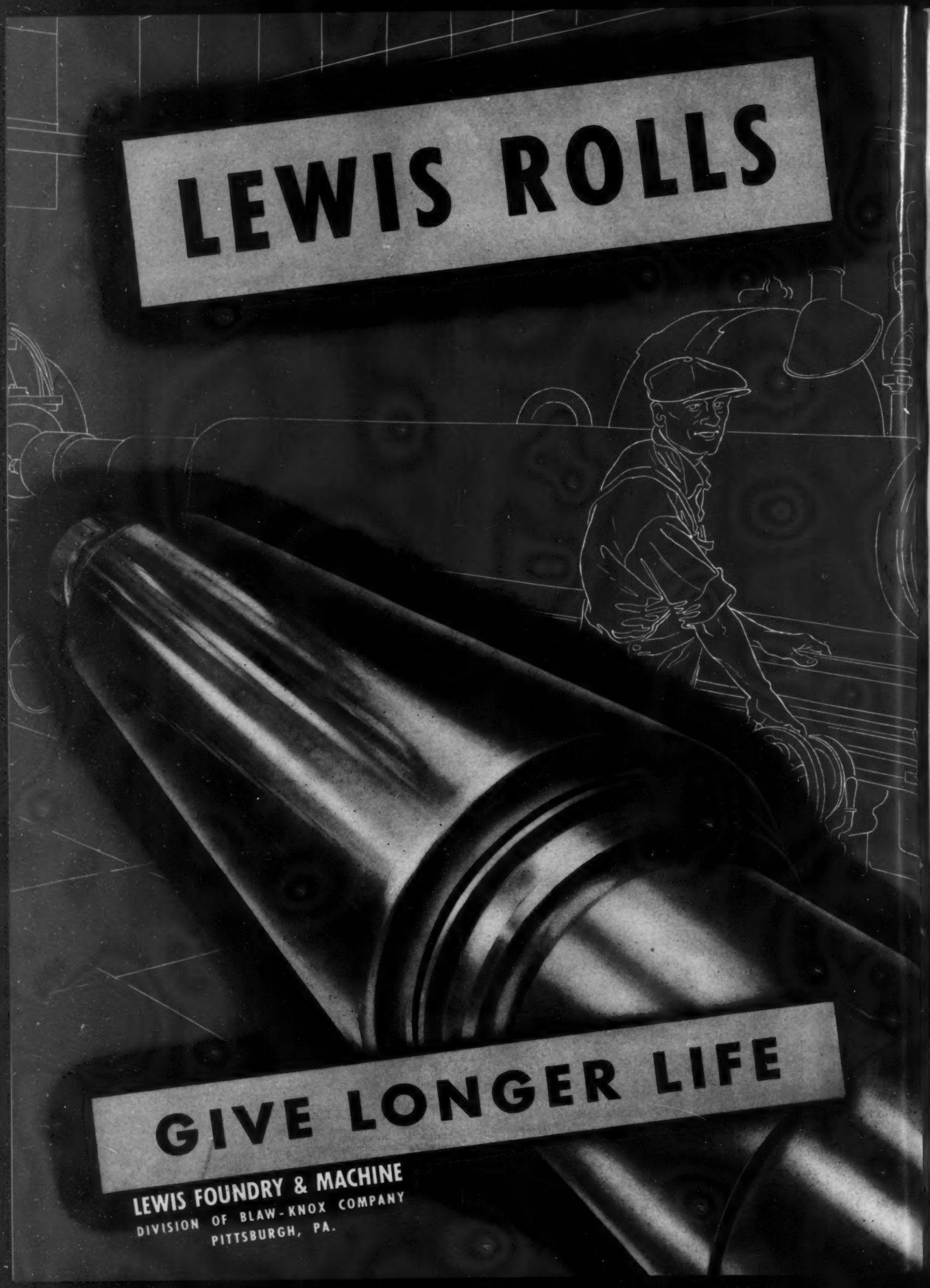
Can be Fused into Homogeneous Structure

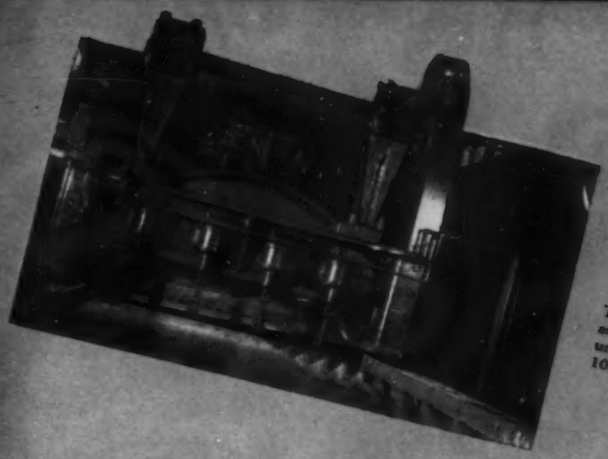
Ends can be instantly bonded by heat sealing, or the completely wrapped harnesses infra-red or oven baked to form a solid mass of insulation.

Note the outstanding characteristics of Fibron Plastic Tapes as listed below. Plan to test these products now. Generous samples will be gladly sent on request.

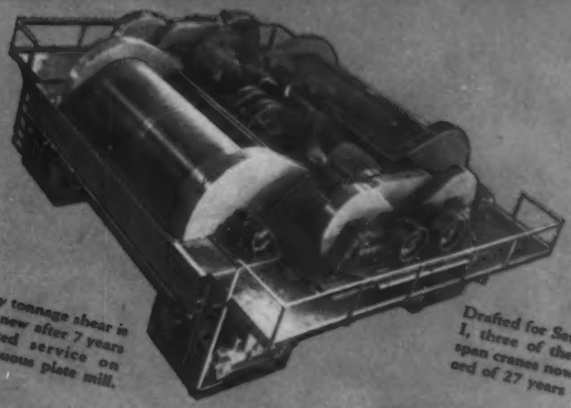
Outstanding Properties of Fibron Plastic Tapes

	#1 Black	#3 Transparent
Thicknesses	.008" .012" .020"	.020"
Widths	½" to 3"	½" to 3"
Dielectric Strength (.012" tape)	1000 VPM	750 VPM
Tensile Strength, lb. per sq. in. (dumbell specimen tested)	1600	1600
Elongation	250% to 400%	350%
Brittleness Temperature	−41 deg. C.	−38 deg. C.
Bonding Temperature (depending on method used)	130°-150°C.	135°-155°C.
Specific Gravity	1.25	1.22


LEWIS ROLLS
GIVE LONGER LIFE
LEWIS FOUNDRY & MACHINE
DIVISION OF BLAW-KNOX COMPANY
PITTSBURGH, PA.



This heavy tonnage shear is as good as new after 7 years uninterrupted service on 100" continuous plate mill.



Drafted for Service in World War I, three of these 336 ton 90' 0" span cranes now have a service record of 27 years without furlough.

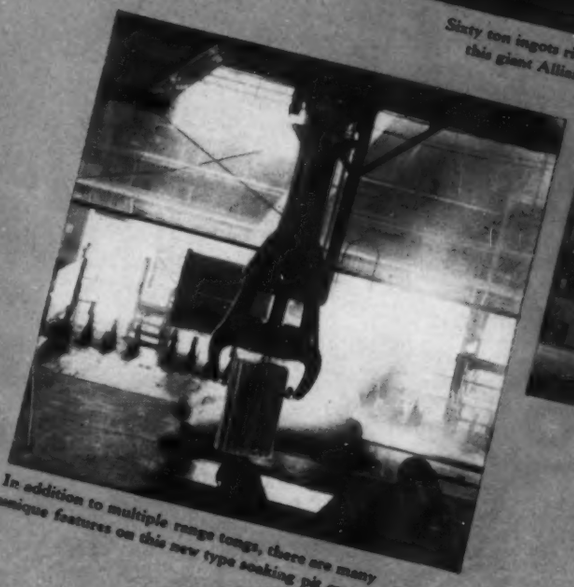
World's Largest Builder of the World's Largest Cranes

Alliance ladle cranes have an extra safety feature in the method of reeving hoist ropes . . . an Alliance patent.

LADLE CRANES · GANTRY CRANES · FORGING MANIPULATORS · SOAKING PIT CRANES · STRIPPER CRANES · SLAB AND BILLET CHARGING MACHINES · OPEN HEARTH CHARGING MACHINES

Sixty ton ingots ride to the plate mill in this giant Alliance Ingot Chariot.

Alliance has been building cranes and other mill equipment since 1901.



In addition to multiple range tongs, there are many unique features on this new type soaking pit crane.

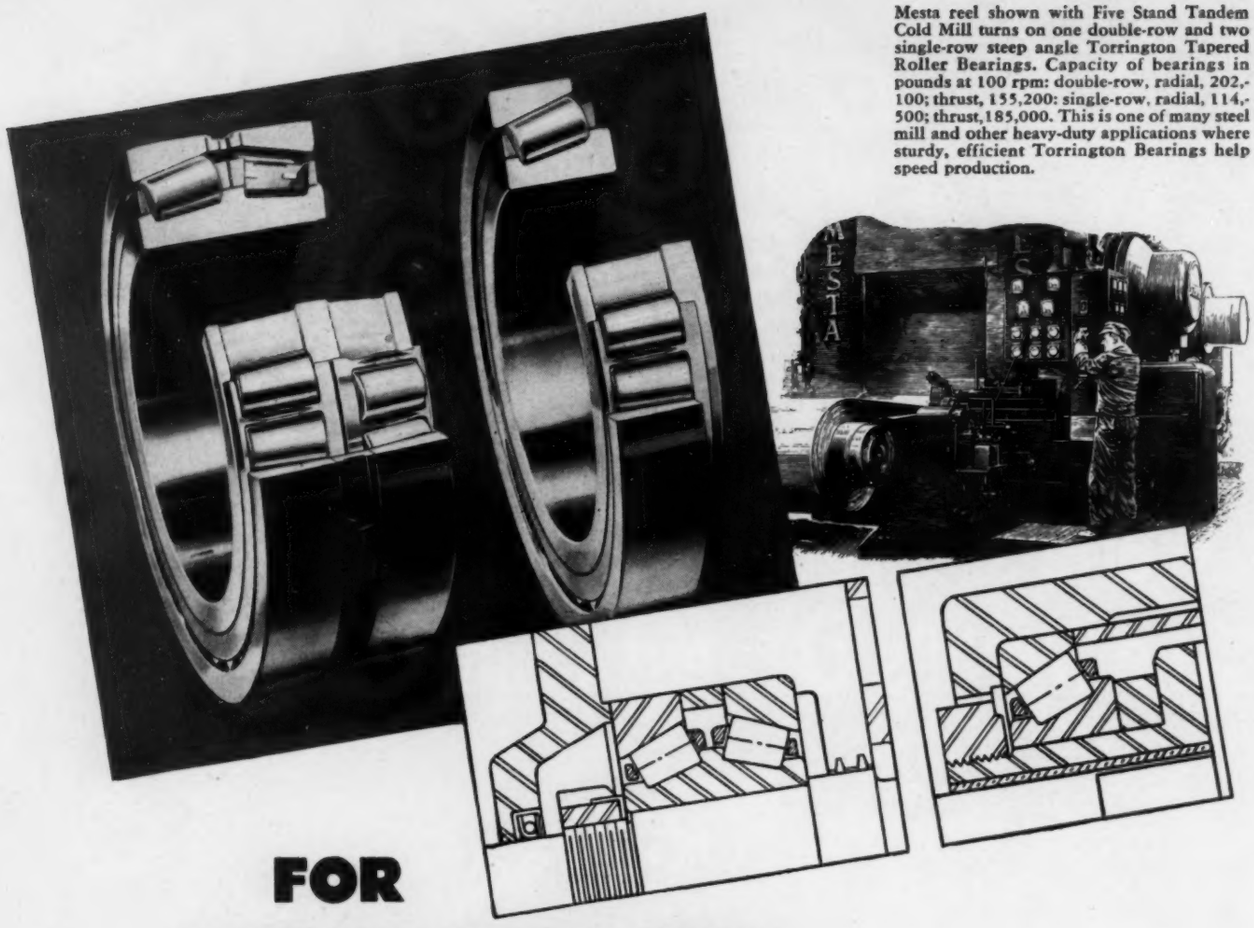
To grip, lift, and swing a 20 ton ingot at a radius of 28 feet, Alliance built 400,000 pounds of useful weight into this ingot charging machine.

ARMY E NAVY

THE ALLIANCE MACHINE CO.
ALLIANCE, OHIO

PITTSBURGH, PA., OFFICE — 1622 OLIVER BLDG.

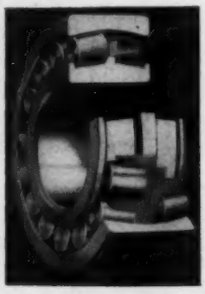
Alliance



Mesta reel shown with Five Stand Tandem Cold Mill turns on one double-row and two single-row steep angle Torrington Tapered Roller Bearings. Capacity of bearings in pounds at 100 rpm: double-row, radial, 202,-100; thrust, 155,200: single-row, radial, 114,-500; thrust, 185,000. This is one of many steel mill and other heavy-duty applications where sturdy, efficient Torrington Bearings help speed production.

FOR FASTER COLD MILL REELS...AND OTHER STEEL MILL EQUIPMENT

THE TORRINGTON SELF-ALIGNING SPHERICAL ROLLER BEARING



assures self-alignment, two-directional thrust and unit construction for easy installation and handling. It will be manufactured in a complete range of sizes from 1.5748" bore and up. See your nearest Torrington Representative or write for Bulletin #100A.

One double-row and two single-row, steep angle Torrington Tapered Roller Bearings efficiently handle extreme radial and thrust loads on this cold mill reel. One of the world's fastest, it "coils" 3,200 feet of strip per minute...and at required tension for final quality control.

In reels, screw-downs and edgers . . . on work rolls, back-up rolls, shears and drives . . . on table rolls, pinion stands and other steel mill equipment... Torrington Bearings will provide efficient, economical operation with a minimum of maintenance attention.

In the competitive markets of today, you should assure yourself of that kind of performance from *your* steel mill machinery. Our engineers will gladly help yours to incorporate Torrington Bearing advantages in your designs.

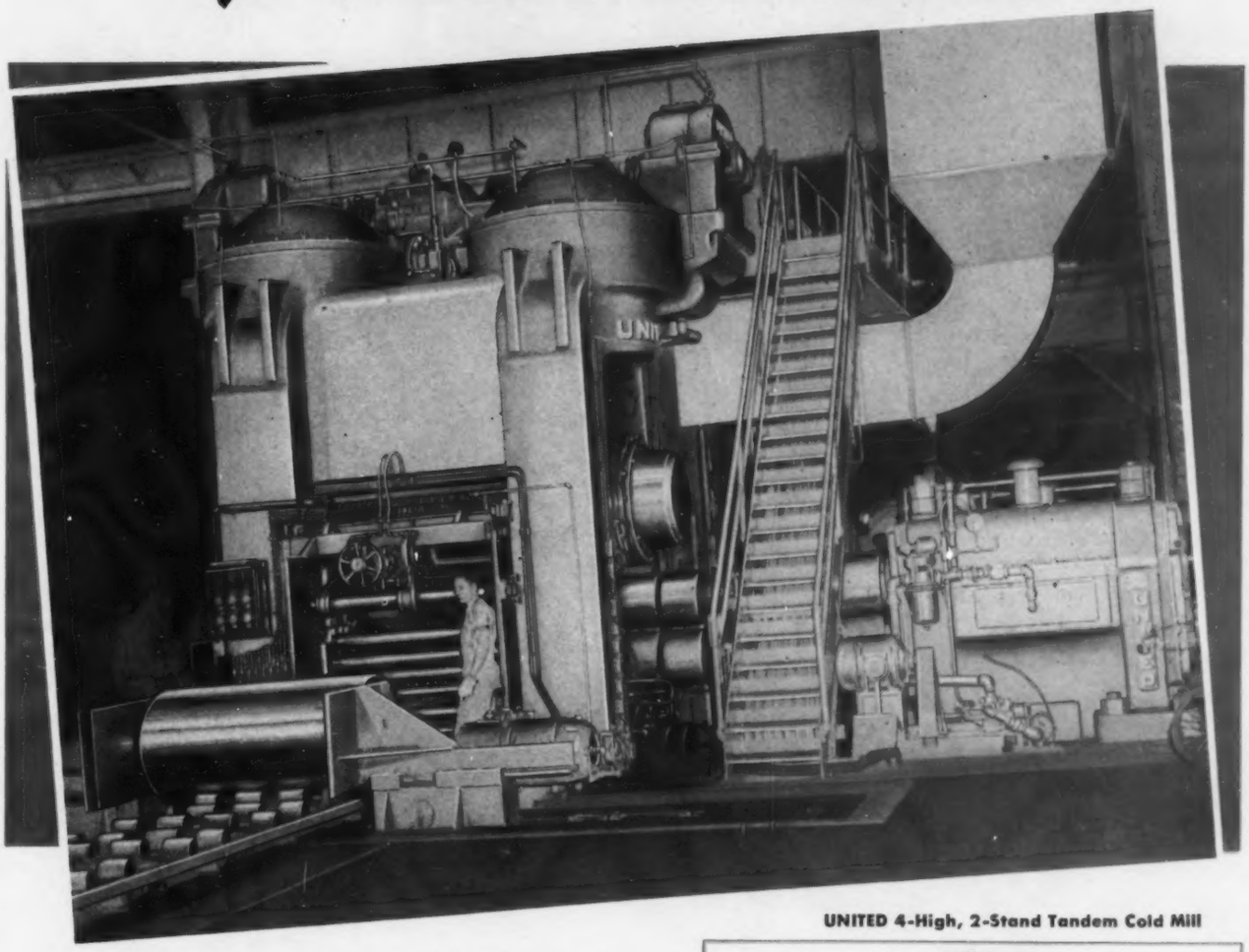
THE TORRINGTON COMPANY • BANTAM BEARINGS DIVISION
SOUTH BEND 21, INDIANA

TORRINGTON BEARINGS

SPHERICAL ROLLER • STRAIGHT ROLLER • TAPERED ROLLER • NEEDLE • BALL

For Fast, Accurate, Economical rolling of Aluminum and other non-ferrous metals . . .

UNITED
4-HIGH COLD MILLS



UNITED 4-High, 2-Stand Tandem Cold Mill

Long recognized as the best type of mill for rolling both hot and cold strip steel, UNITED 4-HIGH MILLS are also quite generally employed in the non-ferrous industry for both hot rolling and cold intermediate rundown and finishing. Wherever used, greater tonnages, and a product of extreme accuracy have been obtained.

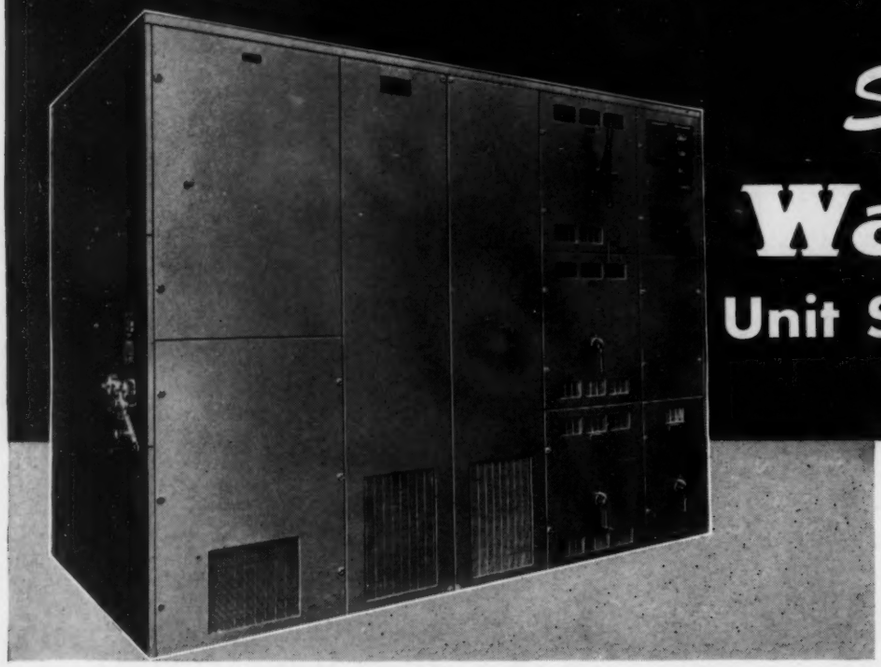
At your request, our engineers will furnish complete data on the 4-HIGH COLD MILL illustrated, and on other UNITED mills for ferrous or non-ferrous applications. Your inquiry entails no obligation.

UNITED ENGINEERING AND FOUNDRY COMPANY

PITTSBURGH, PENNSYLVANIA

Plants at Pittsburgh, Vandergrift, New Castle, Youngstown, Canton
Subsidiary: Adamson United Company, Akron, Ohio
Affiliates: Davy and United Engineering Company, Ltd., Sheffield, England; Dominion Engineering Works, Ltd., Montreal, P.Q. Can.

The World's Largest Designers and Makers of Rolls and Rolling Mill Equipment



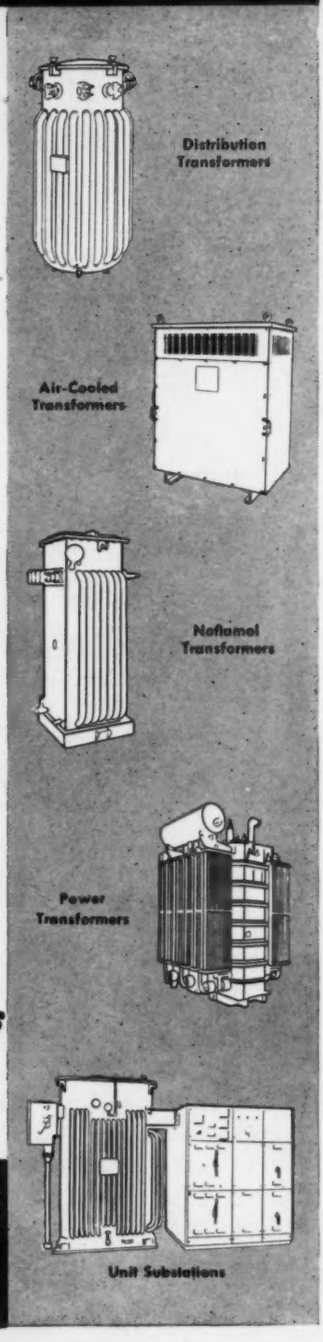
Specify Wagner Unit Substations!

One order to Wagner brings everything needed to meet your exact transformer and switchgear needs—a complete unit substation engineered as a single unit, fully backed with undivided responsibility by Wagner.

Wagner unit substations are easy to install—and when future load changes so dictate, easy to move intact to a new location.

In addition to (1) ease of ordering, (2) undivided responsibility, (3) simplicity of installation and (4) ease of relocation, Wagner unit substations offer you such other important advantages as (5) less installation expense, (6) maintenance is simplified, (7) low-voltage feeders are shortened, (8) less manpower needed to make changes, (9) built of the highest-quality materials in accordance with the latest engineering practices.

Get acquainted with entire Wagner line of distribution and power transformers. Ask for Bulletins TU-180 and TU-181, gladly sent on request addressed to Wagner Electric Corporation, 6483 Plymouth Avenue, St. Louis 14, Mo.



Other Wagner Products for Industry: Air Brakes • Brake Lining • Electric Motors • Hydraulic Brakes • Industrial Braking Systems • NoRoL • Tachograph

Consult Wagner Engineers on all Transformer Problems

Wagner

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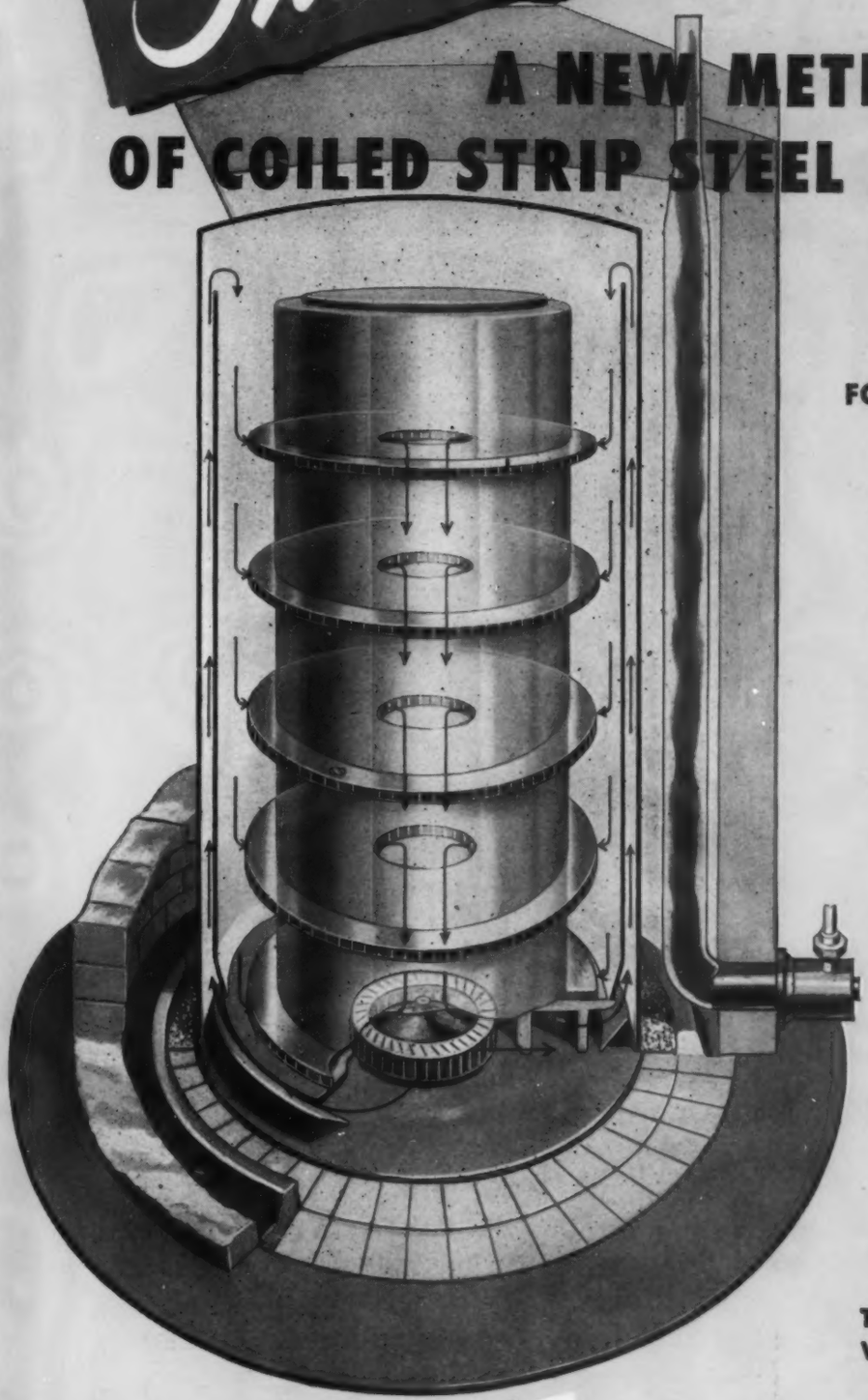
A NEW METHOD OF COILED STRIP STEEL ANNEALING—BY WILSON



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- More Tons per Hour
- Better Uniformity
- Less Floor Space
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- The Highest Quality of Sheet and Tin Plate Coil Annealing Yet Attained in the Industry

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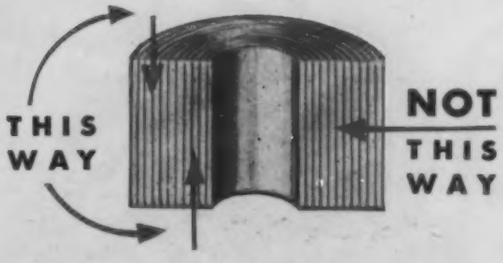
RADIANT CONVECTOR

BELL TYPE FURNACE

APPLIES HEAT TO THE COIL EDGES



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Lee Wilson **ENGINEERING COMPANY, INC.**

20005 WESTLAKE ROAD • CLEVELAND, OHIO

Sold by The WEAN ENGINEERING CO., Inc., Warren, Ohio

INDUSTRIAL FURNACES • RADIANT TUBE HEATING • HEAT TREATING PROCESSES

TIMKEN Tapered Roller BEARING EQUIPPED

45,000 pounds per bite WITH TIMKEN BEARINGS taking the load

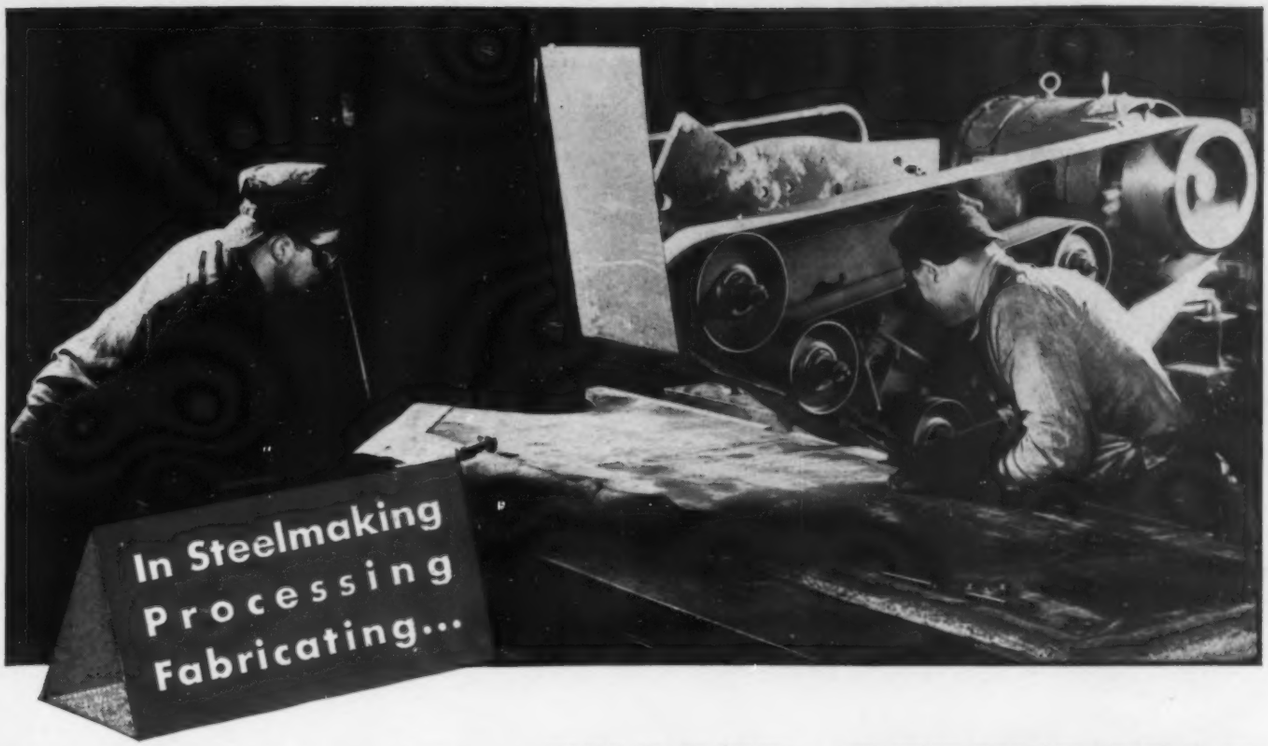
The ore bucket shown in the photograph is one of the largest ever built, weighing 49,000 pounds and having a nominal rated capacity of from 45,000 to 50,000 pounds per bite. It was designed and built by Blaw-Knox Company, Pittsburgh, Pa., who supplied 4 of them to a large Chicago steel company where they went into operation in the summer of 1941.

All sheaves turn on double Timken Tapered Roller Bearings, and as shown by the bucket manufacturer's records, no bearing replacements have been made to date.

This is the kind of bearing service you need and should have not only in ore buckets but in every other kind of steel mill equipment as well, including hot and cold rolling mills, rolling mill drives; pinion stands and runout tables; shears; cranes; ingot cars; ladle cars and slag cars.

To be sure of getting this kind of service when buying Timken Bearings, look for the trade-mark "TIMKEN" stamped on every bearing you use. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN
TRADE-MARK REG. U.S. PAT. OFF.
TAPERED ROLLER BEARINGS



No job too tough for RUGGED, DEPENDABLE RELIANCE MOTORS...

Fully enclosed, Fan-cooled Reliance Squirrel-cage A-c. Motor for Heavy Duty Service

The Reliance Precision Bearing Mount affords complete protection to bearings and windings.

● Where they must take punishment day in and day out, Reliance Motors have demonstrated outstandingly *dependable* performance in steel mills, steel processing and fabricating plants.

Reliance Motors are specially designed, both electrically and mechanically, for a long life of trouble-free service on the job—no matter how tough. For operations where abrasive dust particles in the air, moisture or other special conditions threaten motor performance, specify Reliance.

RELIANCE ELECTRIC & ENGINEERING CO.
1084 Ivanhoe Road • Cleveland 10, Ohio

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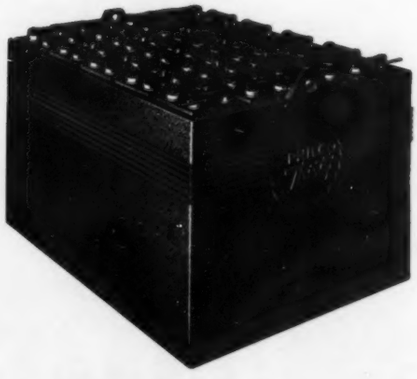
ELECTRIC TRUCKS PALLETIZED LOADS PHILCO BATTERIES

It's the Dollars they Save that Counts!

Now that wide experience with palletized unit loads has proved battery-powered electric trucks the most flexible, safe, cost-saving equipment for handling materials and finished goods—make this knowledge pay off! Go the whole way by powering your electric trucks with the amazing new Philco "Thirty", the high capacity battery that gives 30% longer life! It will save you money. Write for the new Philco "Thirty" catalog.



Philco Corporation, Storage Battery Division, Trenton 7, New Jersey

PHILCO FOR 50 YEARS A LEADER IN INDUSTRIAL STORAGE BATTERY DEVELOPMENT

Use your *OLD* tie-rods in your *NEW* pickling tank

NEW WOOD PICKLING TANK built by **The Hauser-Stander Tank Company**, *Cincinnati, Ohio. Its Monel tie-rods have already seen 7 years of continuous service in the old pine tank pictured at the left.*

Salvage of Monel rods both economical and practical, says HAUSER-STANDER TANK COMPANY, Ohio manufacturer

One test of a tie-rod's merit is its ability to keep a pickling tank tight.

Another, its ability to outlast the tank itself.

On both tests, Monel* tie-rods, nuts and washers show up exceptionally well.

So outstanding is their resistance to corrosive pickling solutions, that **The Hauser-Stander Tank Company** of Cincinnati, Ohio, frequently suggests re-use of Monel tie-rods in new tanks!

Note the illustrations on this page. One tank is new; one is old. *But the tie-rods are the same.* Hauser-Stander took them from the old pine tank where they had seen seven years of continuous service, and used them to bind the new tank.

On occasion, Hauser-Stander has taken Monel rods which have served in *two* wooden tanks, and put them into a *third.* It's possible to do this because corrosion-resistant Monel combines high strength and high yield point with high ductility. Even under severe conditions, Monel retains these properties. That's why it is also possible to take old tie-rods and fabricate them into hooks, eyebars or pickle pins.

When you order new tanks — or find it necessary to re-rod those you have — remember Monel. It's long-lasting. It's safe. It's economical.

*Reg. U. S. Pat. Off.

Monel THE INTERNATIONAL NICKEL COMPANY, INC., 67 Wall Street, New York 5, N.Y.

Where "STAYING POWER" *Counts!*

"Buffalo" DRAFT FANS *Serve Longer*

THESE BOOKLETS CAN HELP YOU

Complete details on lowering draft fan maintenance the "Buffalo" way are *yours for the writing.*

For *Forced Draft Fan* facts, specify Bulletin 3113.

For *Induced Draft* Fans, write for Bulletin 3190-B.

Besides delivering maximum air at least power cost, forced and induced draft fans must possess a high degree of DURABILITY for the endless, punishing task of keeping vital fires at top efficiency.

"Buffalo" Forced and Induced Draft Fans are engineered with extra-heavy rotors, perfectly balanced for smooth running and hot-riveted for enduring rigidity . . . extra husky housings that can absorb the constant beating of years, and may be quickly disassembled and replaced when necessary.

These "Buffalo" fans have earned a low-maintenance, high-delivery reputation in many installations, large and small. It will pay you to consult your nearest "Buffalo" representative for recommendations.

BUFFALO FORGE COMPANY

173 MORTIMER STREET — BUFFALO, NEW YORK

CANADIAN BLOWER & FORGE COMPANY, LTD. — KITCHENER, ONTARIO

"Buffalo"

Forced and Induced

Draft Fans

N·B·M Has The Formulas To Solve Your Bearing Problems

For over 50 years N-B-M metallurgists have been solving special bearing problems for steel mills.

We have perfected scores of bronze alloy formulas to meet every combination of factors which affect bearing performance: Heat, load, lubrication, roll characteristics, even acid water.

Bring your bearing problems to N-B-M. We have the answers — or we'll find them!

N·B·M
BRONZE & COPPER CASTINGS

Blast Furnace Copper Castings • Roll Neck Bearings
Slippers • Housing Nuts • Machinery Castings • Babbitt
Metals • Acid Resisting Castings • Phosphorized Copper

NBM
NATIONAL BEARING
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PLANTS IN: ST. LOUIS, MO. • PITTSBURGH, PA. • MEADVILLE, PA. • JERSEY CITY, N. J. • PORTSMOUTH, VA. • ST. PAUL, MINN. • CHICAGO, ILL.

E&M TYPE A

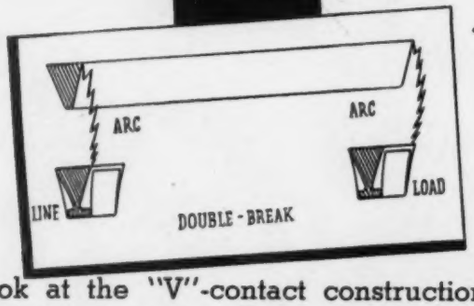
SAFETY SWITCH

- HEAVY DUTY
- HANDSOME
- COMPACT
- DURABLE

HAS "V" CONTACTS for

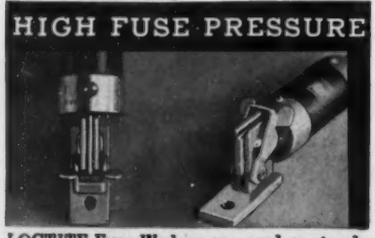
1 Quick *BREAK* of the ARC

2 High current carrying capacity at low temperature rise.



Look at the "V"-contact construction used in EC&M Type A Safety Switches. The moving contact is a V-blade which wedges into the stationary V-contacts, equipped with back-up springs for full contact under heavy pressure. It is due to this design that these Type A Safety Switches can carry rated current with low temperature-rise.

Now, let us see what takes place when this switch opens a circuit. The moving V-blade quickly leaves the two V-stationary-contacts, giving a double-break. Any arc that may be formed as the circuit is opened runs up either of the sloping sides of the contacts to cause a quick rupture. This construction is simple and reliable, too.



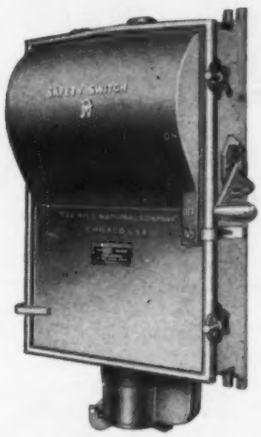
LOCTITE Fuse Wedges are used as standard on all 200-ampere and larger safety switches arranged for fuses.

EC&M Safety Switches are available in all standard sizes, in double, triple and four-pole design and for use on both alternating and direct current circuits. Bulletin 1300 gives complete details on design, ratings, dimensions, etc. Send for your copy to-day.

THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79th STREET • CLEVELAND 4, OHIO

Heavy-duty Safety Switches & Circuit Breaker Pylets

Circuit breaker Pylet with interlocked receptacle and QuelArc plug.



Safety Switches: 2, 3, and 4 pole; 30, 60, 100 and 200 amperes; 125, 250 and 600 volts; fusible type, with or without interlocked receptacle for QuelArc plug.

These Pyle-National safety switches are built for mill and railroad service, with the substantial construction needed to withstand severe operating conditions. Case and cover are heavy-section galvanized cast iron; operating parts are heavy cast metal, and designed for quick make and break action. Contacts are mounted on heavy slate. The operating shaft has bronze bearings. The case is fully protected, with both cover and hub plates equipped with weatherproof gaskets. The operating lever extends through the case in a rust-proof bearing and the cover is held closed by rust-proof wing nuts and bolts. These features assure dependable service and long life even under severe operating conditions.

Circuit breaker Pylets of similar heavy duty construction are available with or without interlocking receptacle for QuelArc plugs.

Consult your Pylet catalog for complete listings or write for recommendations.

PYLE-NATIONAL
RAILWAY
ELECTRICAL EQUIPMENT
• SINCE 1897 •

THE PYLE-NATIONAL COMPANY
1334-58 North Kostner Avenue • Chicago 51, Illinois
Offices: New York • Baltimore • Pittsburgh • St. Louis • St. Paul • San Francisco
Export Department: International Railway Supply Company, New York
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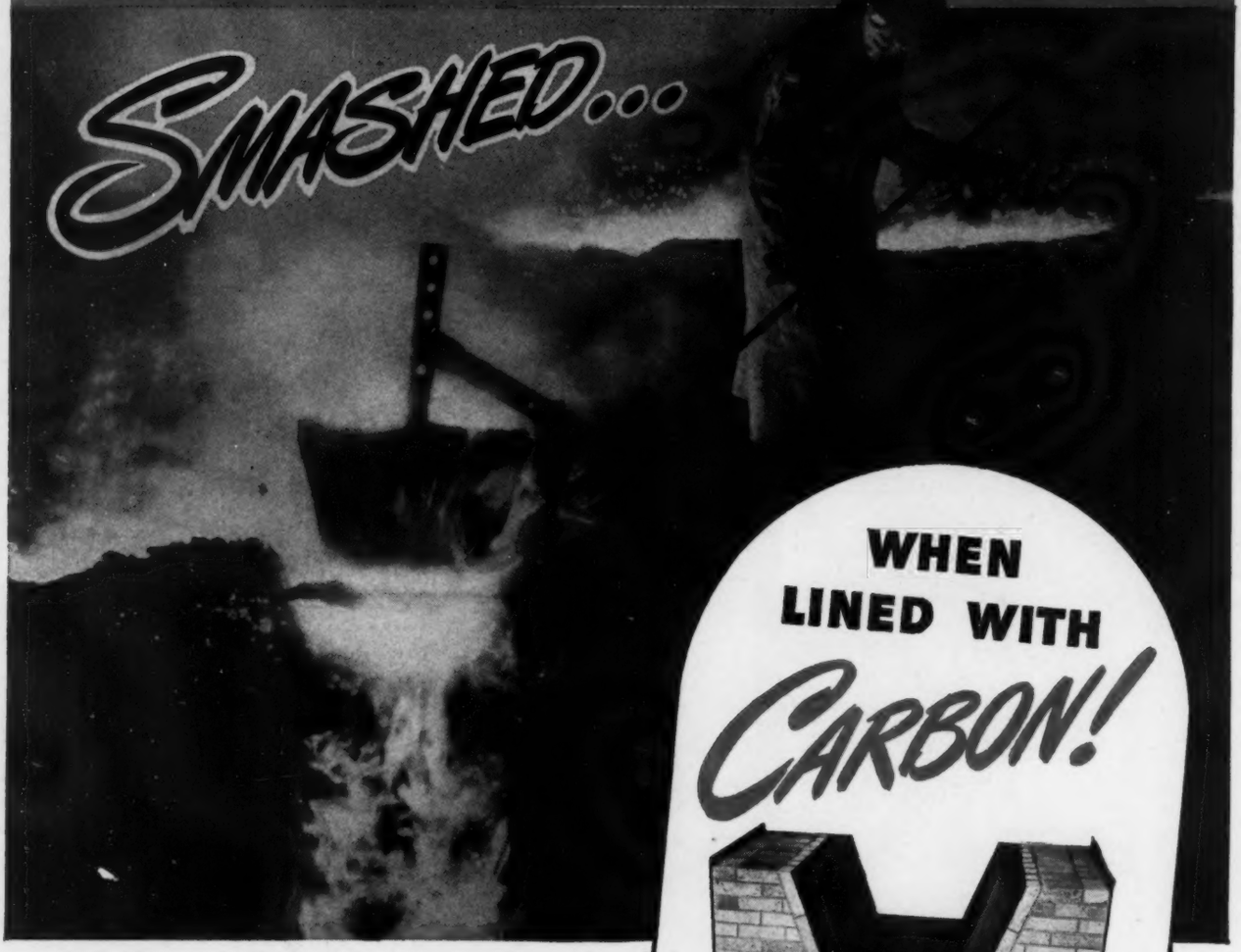
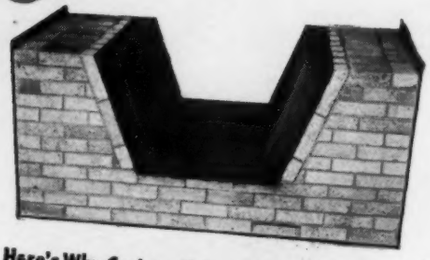
CONDUIT FITTINGS • FLOODLIGHT PROJECTORS • LOCOMOTIVE ELECTRICAL EQUIPMENT

SERVICE RECORDS FOR RUN-OUT TROUGHS

SMASHED...



WHEN LINED WITH CARBON!



A LARGE steel company* lined a run-out trough with "National" carbon blocks, to see how this remarkable material would stand up in such violent, destructive service. The company engineers were well satisfied when the carbon lasted for several days. But the carbon lining went right on! It smashed all existing records for run-out trough linings by lasting for weeks and then for months.

And now...incredible though it may seem... this lining is still in good operating condition—after *two years!*

By lining your run-out troughs with "National" carbon slabs, you can get long life and freedom from hazardous maintenance and rebuilding. Also, you get instant cleaning of the trough — a stream of cold water shatters the metal without in any way harming the carbon slabs.

*NAME ON REQUEST

Here's Why Carbon Slabs Perform So Remarkably as a Run-Out Trough Lining:

1 *Carbon has no melting point!* It retains its mechanical strength well past the highest temperatures attained in handling molten metals.

2 *Carbon is not deformed* under the pressures normally encountered at these temperatures.

3 *Carbon is unaffected by changes in temperature*—no matter how rapid or violent—even from 0°F. to 3300°F. in a few minutes.

4 *Molten metal does not stick to carbon.*

GET MORE FACTS!

Engineers of National Carbon Company, Inc., will give you more information on this application for carbon. For other uses of carbon and graphite, ask for Bulletin M-8000 B. Write Dept. IS.

The word "National" is a registered trade-mark of

NATIONAL CARBON COMPANY, INC.

Unit of Union Carbide and Carbon Corporation

UCC

30 East 42nd Street, New York 17, N. Y.
Division Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco

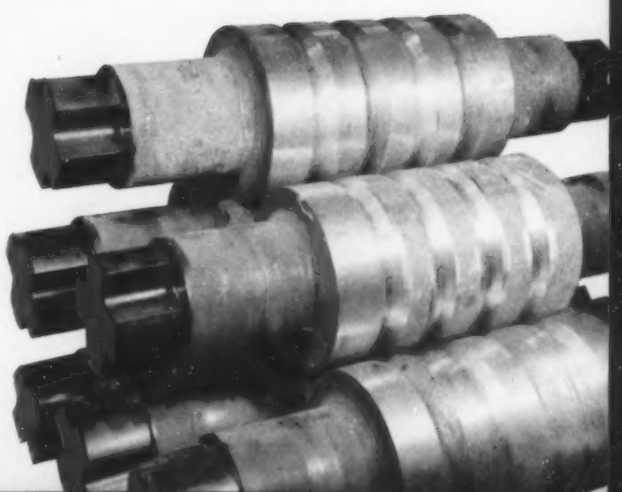
1823: we made the first chilled roll

So what?

We also originated practically every major roll development—so what?

The men who actually do the rolling—your own mill operators—were really responsible for these roll developments. Without your mill "know-how" the roll maker would certainly be handicapped.

But your experience, coupled with Mackintosh-Hemphill engineering, metallurgy, and manufacturing facilities, will produce the results you demand. Red Wabbler rolls will make quick work of your production rolling operations.



MACKINTOSH-HEMPHILL CO. PITTSBURGH & MIDLAND, PA.

Makers of the rolls with the Red Wabblers

The soaking pit manufacturer made his own tests

—then recommended **HAGAN OIL TRANSFORMERS**

Back in the days when the use of fuel oil for soaking pits was still new, the company which had the contract for a large installation in a major steel plant had to choose between Hagan Oil Transformers and a competitive oil measuring element.

Hagan Transformers were already in use in another steel plant, so the company sent its engineers to check on performance. They made their own tests of oil flow-air flow ratios, their own analyses of flue gases—and promptly recommended Hagan.

They have continued to specify Hagan Oil Transformers on soaking pit jobs ever since—in fact one such installation is being made at the present time.

Hundreds of these Hagan Oil Transformers are now in use, not only in connection with installations of Hagan Automatic Combustion Control, but also as replacements for other types of oil measuring devices.

Our engineers will be glad to give you full information.

HAGAN HALL BUROMIN CALGON

HAGAN *Automatic* COMBUSTION CONTROL

The pioneer . . . and still the leader

HAGAN CORPORATION

Hagan Building,

Pittsburgh 30, Pa.

ROLLING TECHNIQUE . . .

Seamless Tube Mill

Surface quality and rigid tensile specifications are essential in the manufacture of seamless tubes — involving a piercing and rolling technique which retains the fine quality of the steel in the tube billet. Here is a rolling task in which Pittsburgh Rolls excel.

Pittsburgh Rolls are made by skilled craftsmen whose thorough practical knowledge of metallurgy, foundry methods and accuracy in roll turning is the accumulated result of over seventy-five years devoted to the exclusive manufacture of Rolling Mill Rolls. The use of Pittsburgh Rolls can result only in *less cost per ton of steel rolled.*

PITTSBURGH ROLLS
Division of Blaw-Knox Company
PITTSBURGH, PA.

PITTSBURGH ROLLS

"A feller named Fluor says we need a FIN • FAN* cooler
... whatever that is."

There's no "moonshine" in the performance record of the FLUOR FIN • FAN Cooling Unit. Engineering data is yours for the asking.

BE SURE WITH FLUOR SINCE 1890

THE **FLUOR** CORPORATION, LTD., 2500 South Atlantic Boulevard, Los Angeles 22, Calif.
NEW YORK • PITTSBURGH • KANSAS CITY • HOUSTON • TULSA • BOSTON
ENGINEERS • MANUFACTURERS • CONSTRUCTORS

When metal first went through the mill

The first rolling mill in this country was on the Chester Creek in the Colony of Pennsylvania. It was built in 1746 by John Taylor, the descendant of an English settler, for his "Sarum Ironworks." The plant had "three stacks" and worked at "full blast," turning out iron bars which were hauled to Marcus Hook for shipping.

Today not only rolling mills but ingot cars, cranes and all the heavy machines used in the steel industry are equipped with anti-friction bearings, many of which are furnished by SKF. For SKF Bearings support tremendous loads and their built-in alignment compensates for shaft deflections.

Since SKF makes so many kinds of ball and roller bearings, an SKF engineer can give you expert help in selecting

THE RIGHT BEARING FOR THE RIGHT PLACE

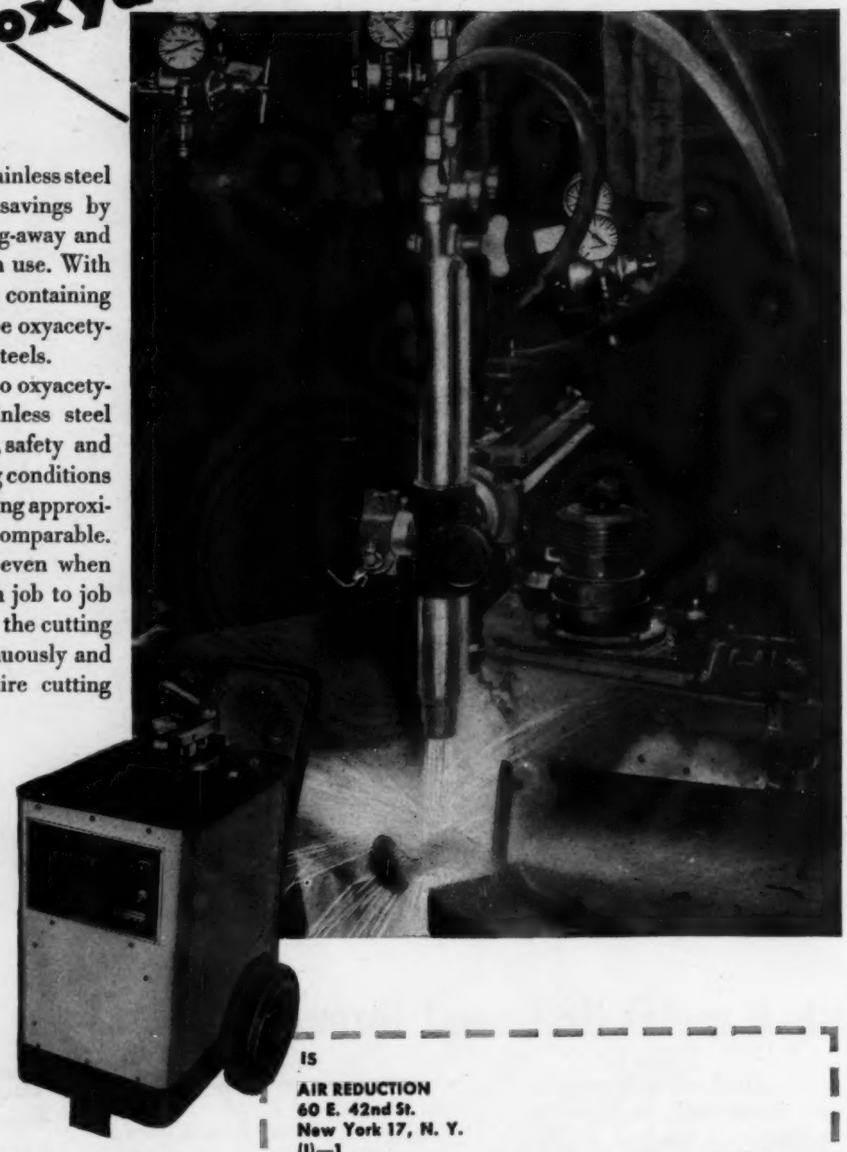
SKF INDUSTRIES, INC., PHILA., PA.

SKF

BALL AND ROLLER BEARINGS

7005-A

here it is! the answer to stainless steel cutting with the oxyacetylene flame



Airco's new Flux-Injection Method of stainless steel cutting points the way to important savings by eliminating the slow, laborious melting-away and mechanical processes now in common use. With the NEW Airco process, stainless steels containing alloying elements as high as 50% can be oxyacetylene flame cut as readily as ordinary steels.

Designed for use with standard Airco oxyacetylene equipment, this new Airco stainless steel cutting technique keynotes simplicity, safety and economy of operation. In fact, operating conditions and instructions for stainless steel cutting approximate mild steel, and "cut-speed" is comparable.

The Flux Feeder Unit is portable, even when fully charged, so rapid movement from job to job is assured. The Unit feeds the flux into the cutting oxygen stream. Thus, the flux is continuously and evenly dispersed throughout the entire cutting operation.

An explanatory article — "Flux-Injection Method Brings Economies of Oxyacetylene Flame Cutting to Stainless Steels"—will be available shortly. Fill in and mail the coupon for your copy. Air Reduction, General Offices, 60 East 42nd Street, New York 17, N. Y. In Texas: Magnolia Airco Gas Products Company, General Offices, Houston 1, Texas. Represented internationally by Airco Export Corporation.

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AIR REDUCTION
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New York 17, N. Y.
(I)—1

Please send me a copy of article: "Flux-Injection Method Brings Economies of Oxyacetylene Flame Cutting to Stainless Steels"

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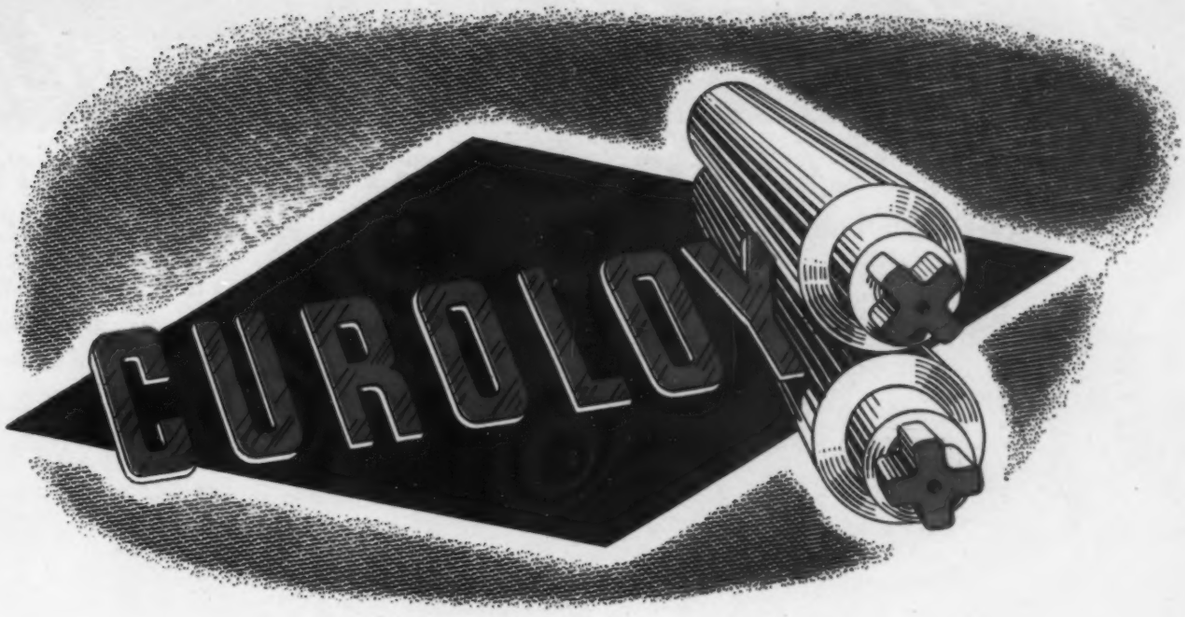
ORIGINATORS OF MODERN OXYACETYLENE AND ELECTRIC ARC METHODS FOR METAL FABRICATION



The Birdsboro patented grain roll for Roughing, Semi-Finishing and Finishing of mild, alloy, tool and special steels; non-corrosive irons and steels; non-ferrous metal bars and shapes at

Type Rolls (Pat.)

Birdsboro "30"
Birdsboro "40"
Birdsboro Metal
Curoloy
Grainloy
Superloy
Bronze Wabbler

Available in four grades—Hard, Medium, Mild and Extra Mild to meet your specific requirements. If it's a roll problem, consult Birdsboro.

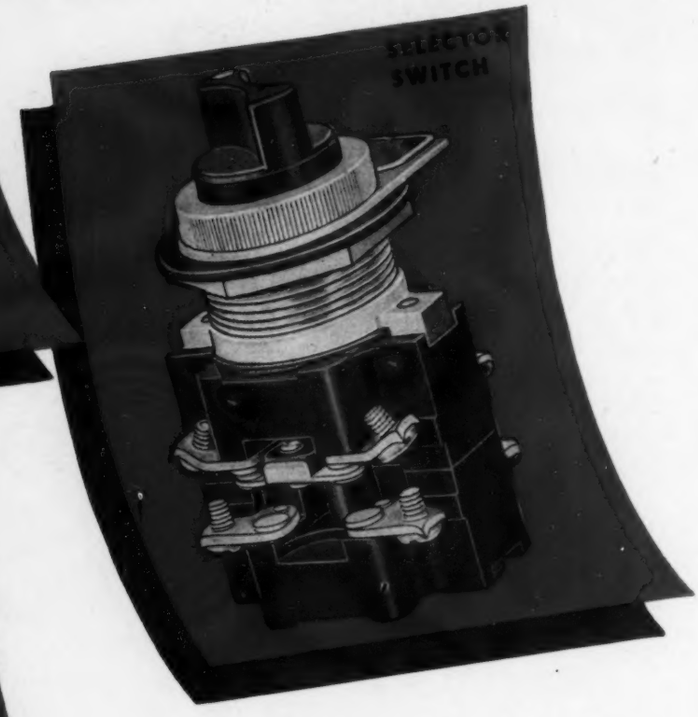
BIRDSBORO STEEL FOUNDRY & MACHINE COMPANY • BIRDSBORO, PENNSYLVANIA

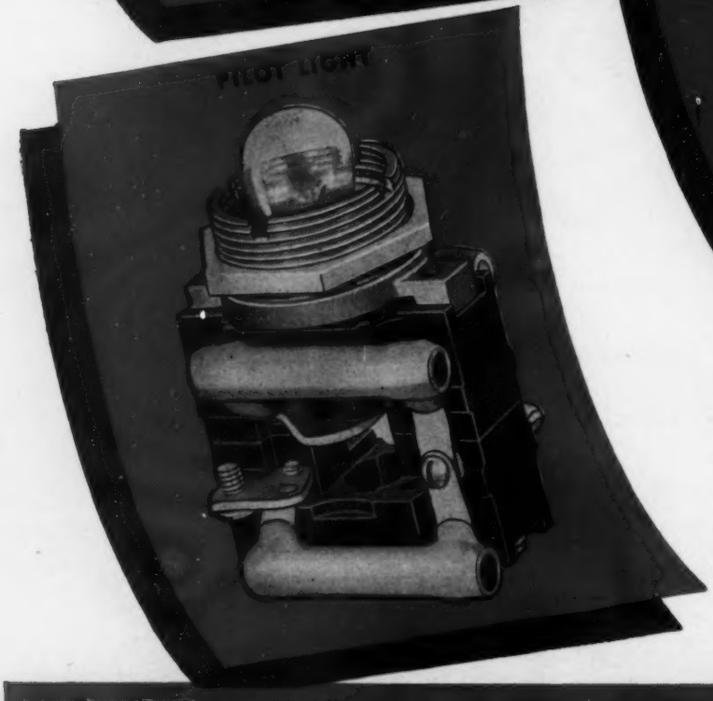
Manufacturers of Steel Mill Equipment, Iron and Steel Rolls, Hydraulic Presses, Crushing Machinery, and Special Machinery

Another "3C" Achievement!

PERMANENTLY OIL TIGHT PUSH BUTTON, PILOT LIGHTS *and* SELECTOR SWITCHES *for use on Machine Tools*

Now you can avoid fouling contacts from seepage of oil or cutting compounds with these new "3C" developed Push Button Elements, Pilot Lights and Selector Switches that are *entirely oil tight*. A steel faced oil-tight washer is held snugly against both front and rear of the panel by close fitting nuts. An oil-tight boot closely grips the button, effectively sealing it against leakage.





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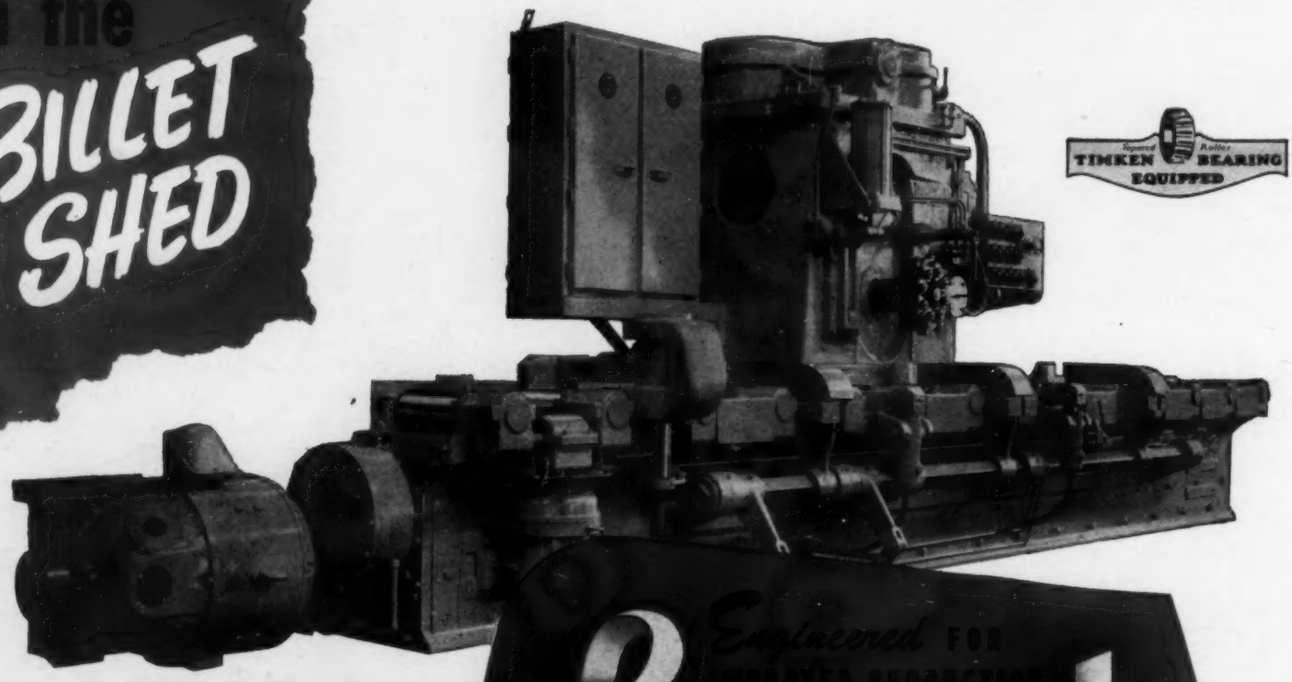

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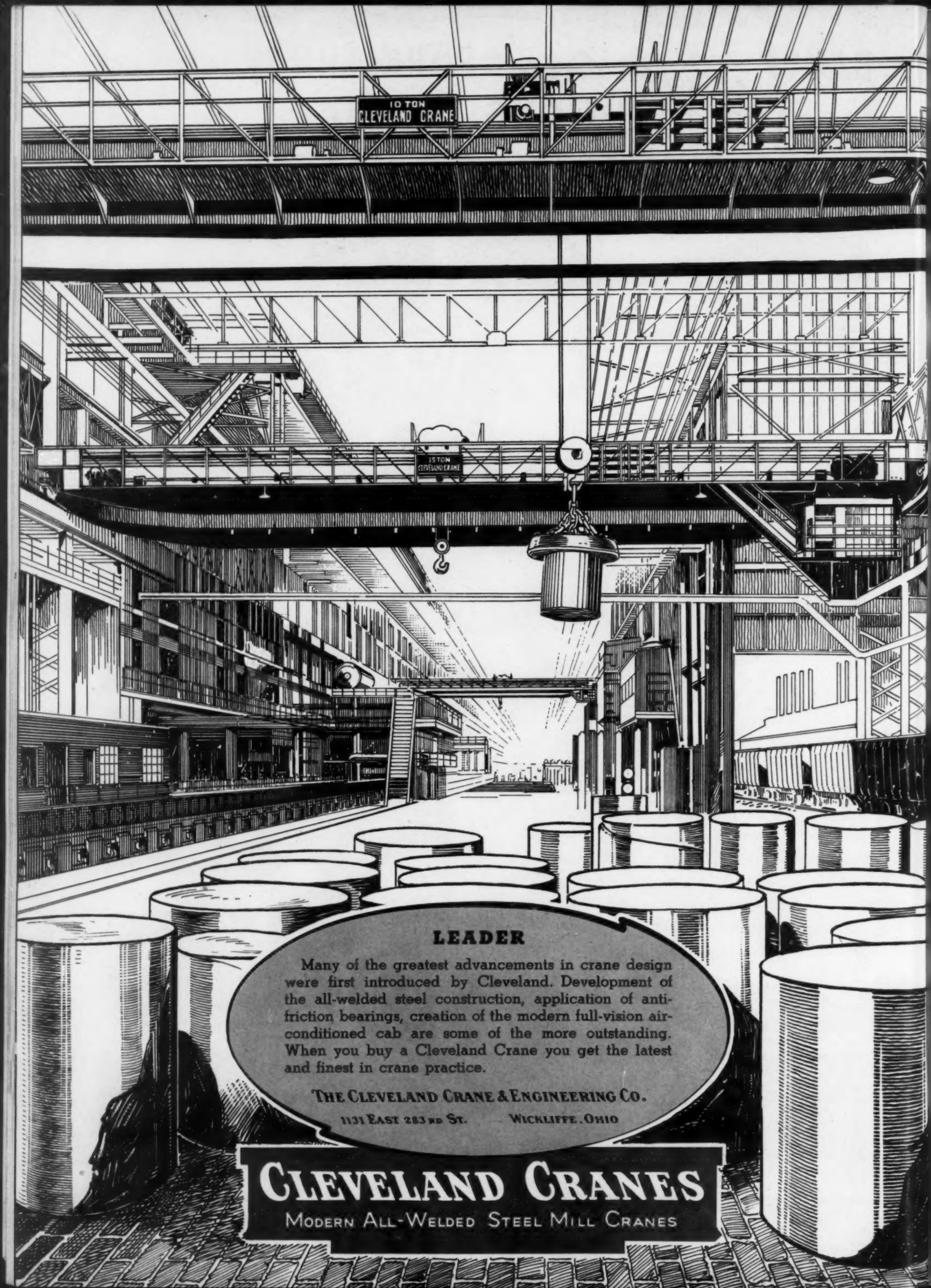

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INGOT production for the first half of 1946 totaled 27,364,714 net tons, about 60 per cent capacity. In 1945, production for the first half totaled 43,143,082 tons. Certainly, it's marvelous progress we are making.

▲

BRITISH steel production is averaging about 1,200,000 tons per month, with an average pig iron production of about 718,000 tons of pig iron per month. This is somewhat higher than the averages in 1944 and 1945. On the other hand, French steel production (about 360,000 tons per month) and pig iron production (about 260,000 tons per month) is averaging over twice their 1945 average but only about one-half of their prewar average.

▲

SPEAKING before the American Iron and Steel Institute, Leo Wolman, professor of economics at Columbia University, outlined several steps necessary for labor peace: A complete rewriting of the Wagner Act; the adoption of a clear statute defining rights and responsibilities; and the return of administrative boards to their place. Another of the serious troubles was stated to lie in the fact that employers are not close enough to their workers.

▲

A SEVERE shortage of lamb and mutton may be forthcoming if the song "There'll Never Be Another You" doesn't soon lose its popularity — it's causing the rams to commit suicide.

▲

ACCORDING to report M. M. S. 1428 of the Bureau of Mines, by-product yields per ton of coal coked during 1945 averaged 7.95 gal of tar, 20.21 lb of ammonium sulphate, 10,330 cu ft of gas and 2.84 gal of light oil. Coke production for the year totaled 62,094,288 tons from by-product ovens and 5,213,893 tons from beehive ovens. The report also shows a total of 14,510 by-product ovens and 12,179 beehive ovens in existence at the end of 1945.

▲

PRODUCTIVE output per man-hour is about 112 per cent of the prewar average, while pay roll per man-hour is 182 per cent of the prewar average. This is the simplest reason for the advance of prices we have seen so far. But price advances create further demands for wage increases to meet the greater cost of living. Walkouts in protest of rising prices only aggravate the complaint, as the failure of production to accelerate fast enough to correct the distorted supply-demand relation is one of the basic factors behind inflation. At present it is thought that it will be six to nine months before production rises to a point where prices will be corrected.

▲

FURTHER evidence of the steel industry's plans to improve their facilities is found in the announcement by American Rolling Mill Company of projected expenditures of $68,700,000 up to the end of 1949. Of this amount, $27,200,000 is slated for 1946.

▲

REVISED figures on the purchases of plant equipment to be made in the United States for modernization of the British steel industry show expectations of not more than $16,000,000 to be expended per year. This shrinkage is thought to be due to the growing fear that the labor government plans to nationalize the industry.

▲

TWO months ago we intimated that people were not thinking as much as they might. As a contradiction to this, a reader calls our attention to the fact that patent applications are pouring into the Patent Office at a rate of 8000 per month and are still on the increase.

▲

ACCORDING to a report by W. W. Galbreath, prepared under the auspices of the Technical Industrial Intelligence Branch, U. S. Department of Commerce, a German method for the cold extrusion of steel shapes may open up an entirely new field in ferrous metal processing. In the new process steel is made to flow under pressure into specially designed dies and molds. Many annealing, pickling and machining operations are eliminated and costs are greatly reduced, according to the report which may be purchased from the Office of the Publication Board, U. S. Department of Commerce, Washington, D. C.

▲

ANNUAL earnings of the steel industry averaged 4.89 per cent on the invested capital during 1945, as compared with 7.53 per cent in 1940 and 6.18 per cent in 1937. This shows the results of increased wage rates and generally higher operating costs. An advance in the price of steel of as much as $6.00 per ton is probable in the near future.

▲

ANOTHER important lot of government-owned steel-making facilities have been disposed of with the sale of scattered facilities at Duquesne, Homestead and Braddock, Pennsylvania, to Carnegie-Illinois Steel Corporation for $65,013,000. These facilities include blast furnaces, open hearths, electric furnaces, slabbing mill, plate mill and miscellaneous equipment.

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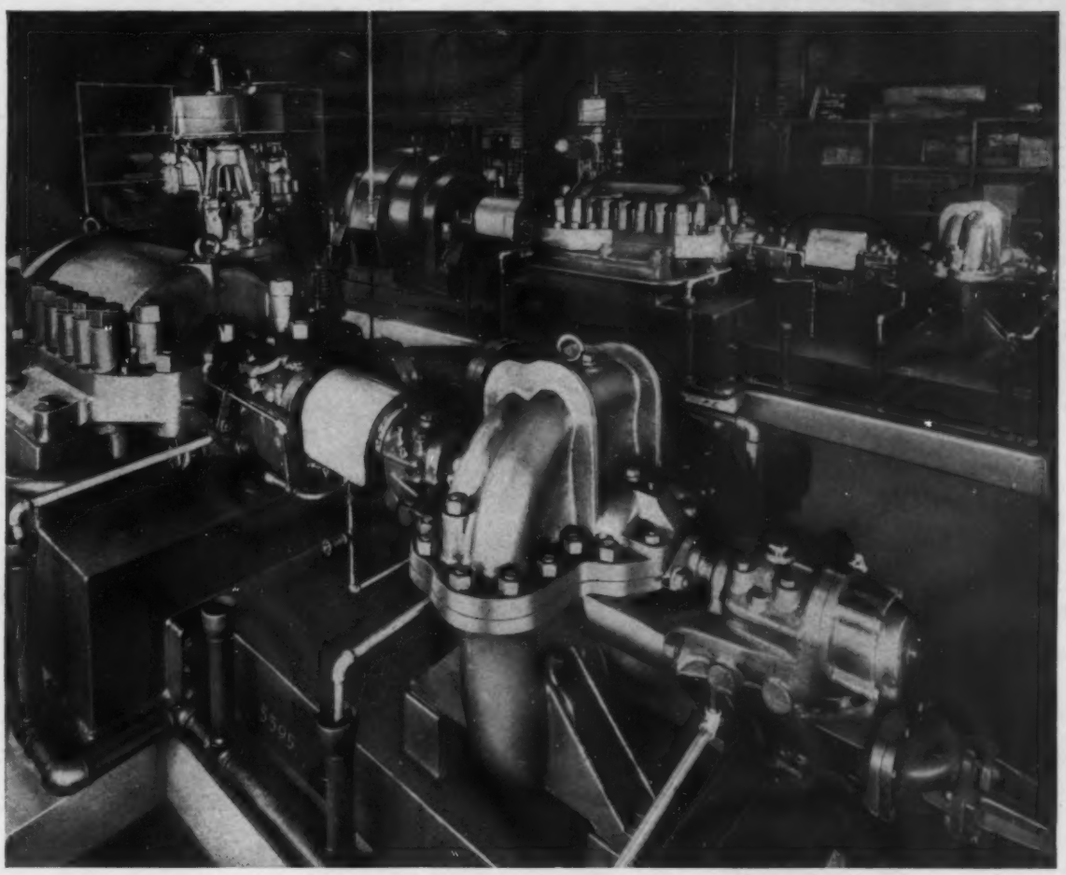

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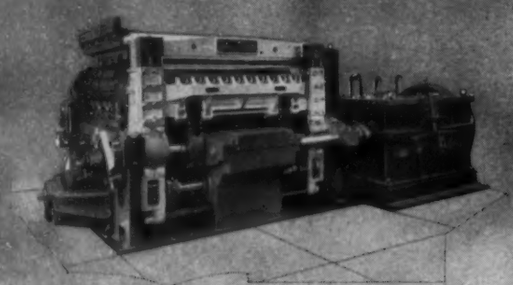

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Iron AND Steel ENGINEER

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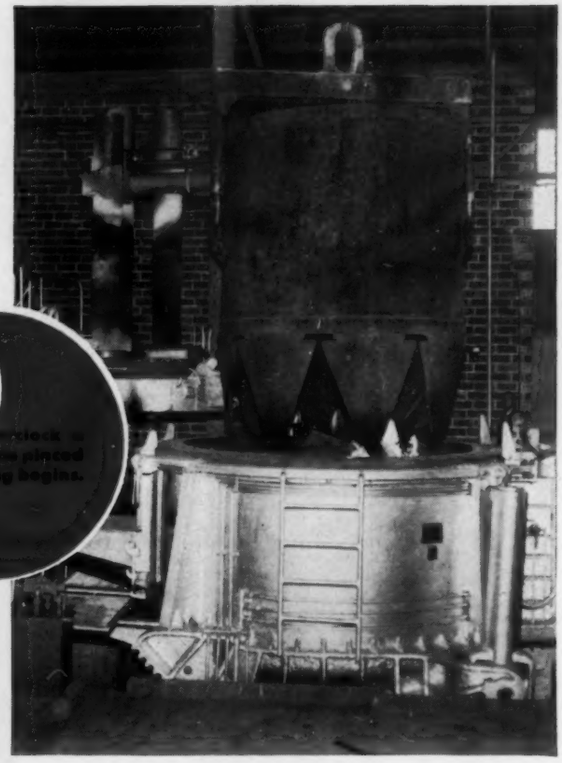
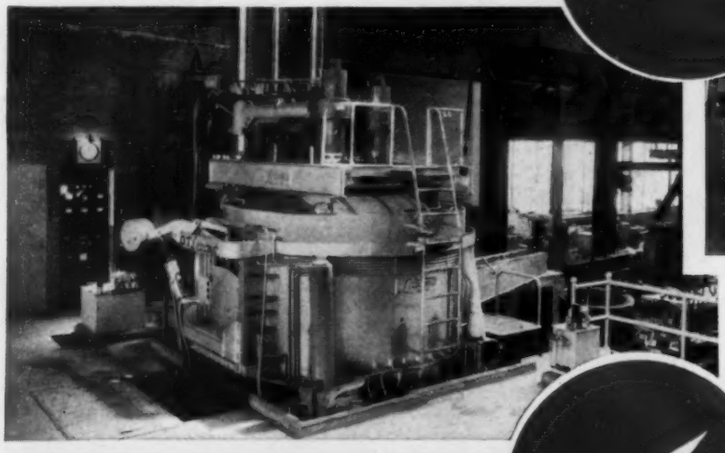
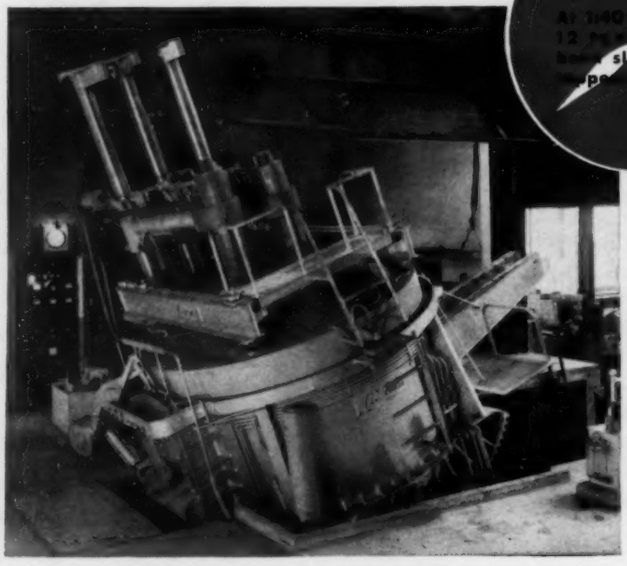
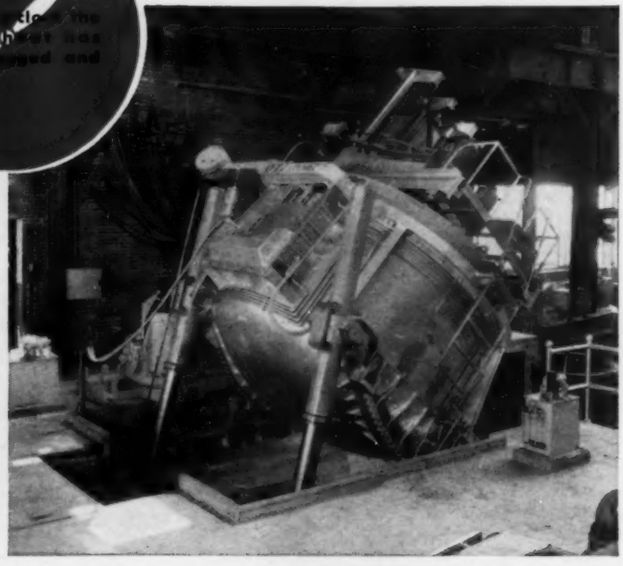




This furnace is size OT (usual heat size 10 to 12 tons). Other equally fast and economical Lectromelt top charge furnaces are available in capacities ranging from 100 tons down to 250 pounds.





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Design of Mill Tables

. . . . although tables are a very important mill auxiliary, little or nothing concerning their design has been published prior to this article . . . .

by James G. Meenan

UNITED ENGINEERING AND FOUNDRY COMPANY

PITTSBURGH, PENNSYLVANIA

▲ THOUGH not the most spectacular units in a steel mill, tables perform a very necessary and important function in handling the material between and during the various processing steps. The table is a relatively simple mechanical device, but its design for economical and efficient operation presents a number of problems. Tables can be divided into two general classes, those with line shaft driven rollers and those with individually driven rollers. The line shaft driven type will be considered first. A large number of these are conveyors of material only, the design of which has been fairly well standardized, and with the details of which most steel engineers are familiar. Others participate in additional operations such as broadsiding and manipulating. For this reason, blooming and slabbing mill tables, will be described in detail, because the problems encountered are of a much more serious nature than those met with in other types of tables.

The designer must not only provide the means for doing the job, but must also consider initial and operating costs, ease of assembly, coordination with other units, and so far as possible, standardization of parts with other tables so that the number and variety of spares may be held to a minimum.

Front and back tables for blooming and slabbing mills are subjected to the most severe usage, particularly in slabbing mills. They must be capable of taking the shock loads as the ingot leaves the mill rolls and as it is turned by the manipulator. They must reverse and accelerate quickly and withstand considerable heat. The table roller, being the primary element, will be considered first. Because of the severity of service, solid forged steel rollers are generally used. The body length should be sufficient to accommodate the maximum width handled in the mill. Actually this means that at times it will be longer than the mill roll by the amount necessary to clear the manipulator side guard, or in the case of broadsiding, by the amount necessary to clear the diagonal length of the ingot or slab. Where broadsiding is done, the mill and tables have a common center line. This, however, is not a general practice on blooming and slabbing mills and will be covered later. When manipulators are used, the center line is generally shifted away from the finger lift mechanism. Spacing should be such that at least two rollers are in contact with the slab at all times and the center distance ranges from 27 to 30 in. Diameters depend on the loads to be carried and vary from 14 to 20 in., 18 and 20 in. being the most common. Table length is governed by the length of the piece to be manipulated and generally runs from 30 to 40 ft. Excessive length cuts down the rate of reversal.

The relation between pass line, which is top of bottom mill roll, and top of roller is very important. If the distance is too great, there is trouble entering the mill bite and a greatly increased impact due to the drop of the slab on the delivery side; if too small, an extremely heavy load is imposed on the table roller nearest the mill on the entry side. Assuming the draft to be equal at the top and bottom of the section being rolled, the absolute minimum distance between pass line and top of roller should be half the maximum draft plus ½ in. An increase in this dimension is permissible if the feed rollers are stepped in elevation so that the transition from table to mill is not too abrupt. When box passes are used in a blooming mill, the portions on the feed rollers and table rollers corresponding to the grooves in the mill rolls may be reduced in diameter to preserve the relationship.

On modern tables, roller bearings have become an almost universally accepted practice. Their selection depends on three factors: ability to withstand shock

Presented before AISE Annual Spring Conference, Chicago, Illinois, May 6, 1946.

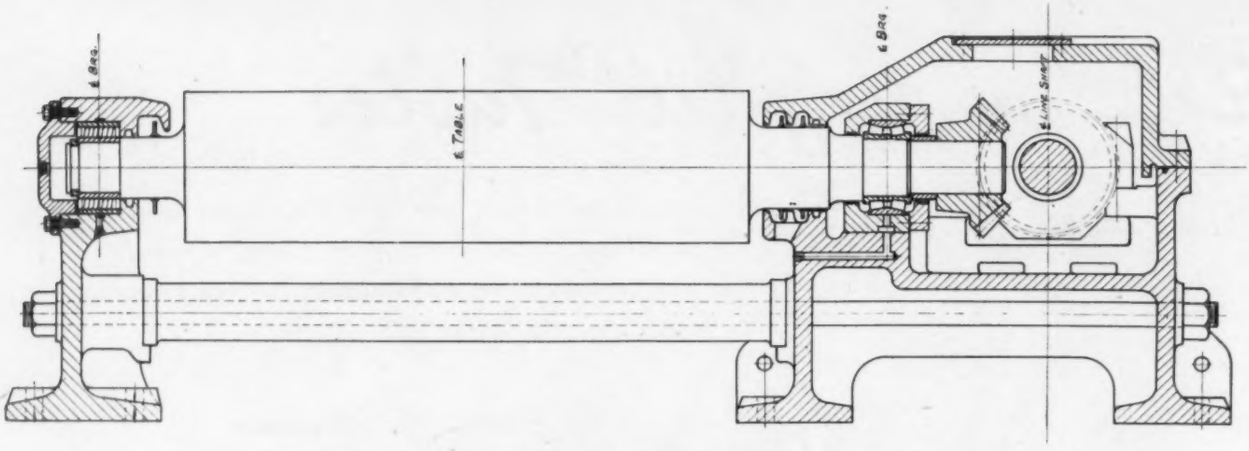


Figure 1 — The table roller design shown allows the roller to be easily removed since the bearing is mounted in a cartridge.

loads, ample projected area of the outer race so that it will not be pounded into its housing, and an inside diameter large enough to insure that the roller itself will be a good structural unit. A double tapered roller bearing is used on the drive side to position the roller and to take the thrust of the bevel gear, and a cylindrical bearing opposite it to permit expansion. There should be more than normal clearance in the bearing itself to allow for the unusual shock and heat conditions. Assuming proper mounting, the life and efficiency of a bearing hinges on the care with which it is lubricated and protected from water and foreign material. High pressure descaling sprays aggravate this problem. It is essential that it be supplied with the right amount of the proper lubricant. Oil and grease have both been used, the latter being by far the most popular because it is easier to hold in the bearing, makes a better seal against the ingress of dirt and water, and it is more easily handled on the dead-eye side of the table. Grease will also withstand high temperature and pressure under conditions which would rupture an oil film, fills up clearances more effectively when wear takes place, and needs less attention. On the other hand, oil is more stable, has less internal friction, will not form as much sludge, and since it is present as gear lubricant anyhow, would eliminate the cost of grease valves and piping. However, since grease is more commonly used, a few salient points should be kept in mind. It should be soft, water repellent, as moisture free as possible, and of a high temperature quality. Separation of oil from soap should not be excessive in the range of operating temperatures. When this occurs, the lubricating and heat dissipating qualities deteriorate and the accumulation of soap in the housing leaves insufficient room for clean grease. It must also be remembered that too much is just as harmful as not enough, as it causes the generation of heat, which may bring about a failure. Any bearing is amply protected when one-third full.

After a table has been operated for a short time, the temperature rises and the grease begins to thin out. Any moisture that is present vaporizes, creating a certain amount of internal pressure, which is relieved on the dead-eye side by a vent. Some of the grease works out through the seal and serves to keep it lubricated. On the drive side, the bearing is protected against the entrance of foreign material from the table proper by the conventional closure and vented to the gear case by way of the clearance between the collar and the spacer which positions the inner race. The collar is provided with grease grooves. This opening permits a small amount of thinned out grease to work into the gear case, where it collects as sludge and should be cleaned out periodically. Pressure operated systems can be timed to deliver a measured amount of grease at stated intervals to every point on the system. Where high temperatures and severe working conditions are encountered, this may have to be done every two hours.

Every effort must be made to keep out water and scale. Some degree of protection is furnished by the bearing caps, which are shrouded to deflect anything striking them. Another form of construction, shown in Figure 1, is more elaborate. The bearing is mounted in a cartridge, bolted to the bed plate and the entire assembly enclosed by the gear cover. Flingers are provided on the roller neck and a drain to carry off the trapped water. In this case, both sides of the bearing are vented to the gear case.

If for any reason it is necessary to take a roller out of the table, means should be provided for doing so quickly and with a minimum of effort. With the construction shown in Figure 1, the fitted bolts holding the cartridge to the bed plate may be taken out and the entire assembly moved far enough toward the center line of table to get the bevel gears out of mesh. This is possible because the shoulder diameter of the shaft is made the same or slightly less than the outer diameter of the inner race of the cylindrical bearing on the other side. This permits expansion during operation and sufficient movement to clear the bevel gears when changing rollers.

When a cartridge is not used, the procedure is a little more complicated. Reference to Figure 2 shows the outer race of the bearing to be held in place by two collars. The one nearest the table center line is split

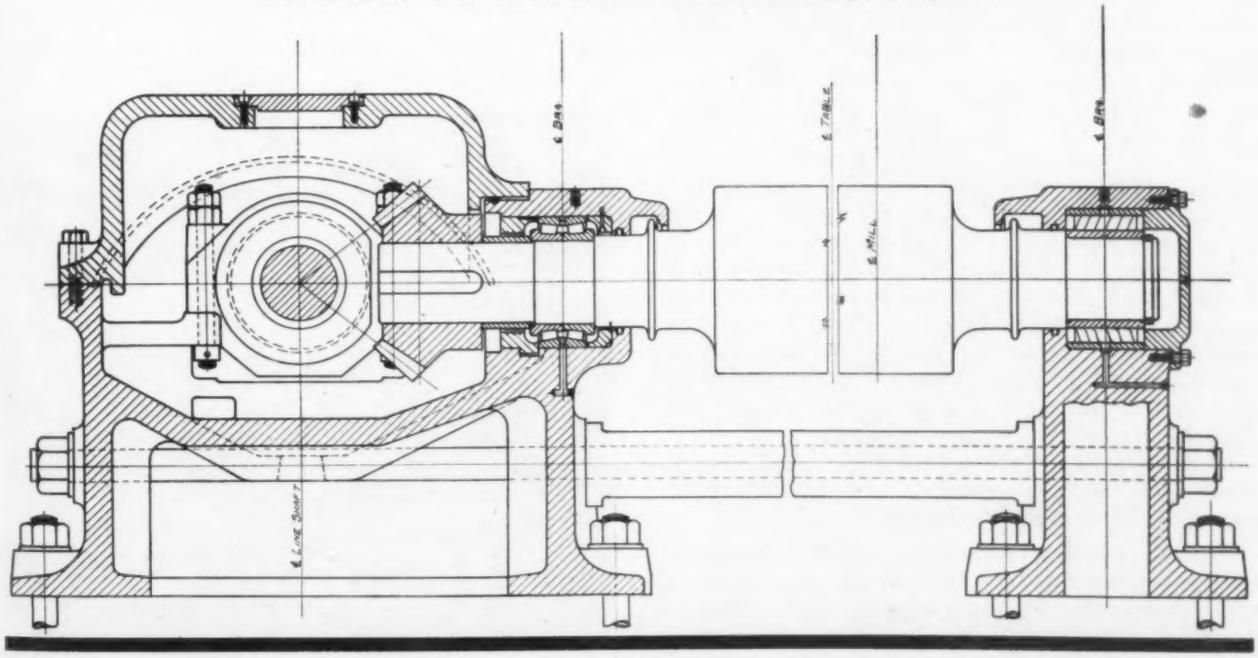
and the upper half being fastened to the cap, lifts out of place when the cap is removed. The collar between the bearing and bevel gear is in one piece, but has a projection half-way around the outer circumference which fits into a groove in the bed plate. By rotating this collar 180 degrees and removing the remaining half collar, the assembly may be slid out of mesh with the line shaft gear and removed. These figures also show the shrouds, seals, flingers, and vents previously mentioned, as well as the greasing provisions.

The line shaft is made of hot rolled, turned, or forged steel, and the composition may vary from mild carbon through the higher carbons, to chrome, nickel, and molybdenum alloys, depending on the loads. The length of a section should be approximately 15 ft, as it is then easily handled and can be replaced with facility. It is supported in the gear case by cylindrical antifriction bearings, with a thrust bearing at the mill end. There are approximately half as many bearings as rollers. The bevel gear faces are always turned toward the thrust bearing, so that any expansion will tend to move the line shaft gears out of mesh with the roller gears, rather than crowd them. It is essential that the thrust capacity of the bearing be great enough to withstand the impact as the section strikes the first roller when leaving the mill. There is no way of computing this impact, so the designer is compelled to rely on his past experience and knowledge of previous successful installations. Bevel gears should be bored with enough clearance to assemble them readily on the shaft, but not enough to make them sloppy. With reversing service, two tapered keys spaced at 90 degrees are used. The end of the gear hub toward which the keys are driven is positioned by a spacer if the thrust is in that direction. The keys are held in place by fillers that are fitted and bolted to the shaft after driving. In some cases, extremely heavy duty gears have climbed the taper on the key, mushrooming the keyway and necessitating the installation of a spacer to provide bearing area for the thrust. It is essential that spacing be accurate because it affects the bearing area of the gear teeth.

As in the case of rollers, means must be provided for removing a section of line shaft quickly. The coupling joining each section to the next one consists of two solid halves and a filler plate. The filler is tongued or grooved, or can be keyed to the coupling halves. It is thick enough so that on its removal, the shaft section to be taken out can be slid along its axis far enough so that the gears may be lifted and rolled out of engagement. The cylindrical bearings are furnished with long inner races to facilitate this movement. Reference to Figure 3 will show the procedure for removing the section upon which the thrust bearing is mounted. After taking out the coupling filler plate, the pins marked "a" are pulled and the cartridge bolts loosened, leaving the shaft and cartridge, which has slotted holes, free to move. It should also be noted that these pins are required to take the entire thrust load, but not in a cross-sectional plane perpendicular to the axis. The joint between the cartridge and the supporting lugs in the bed plate is on the center line of the pin, causing the shear to act along a vertical plane against a much greater area. It is necessary that the lugs themselves be properly designed and ribbed so that the load can be transmitted to the bed plate.

Line shaft and roller gears on reversing mill tables have long been a source of headaches to the designer, operator, and maintenance man. On most tables they are mitre gears, but due to the close roller spacing, 27 to 30 in., which establishes the pitch diameter and face, they are bevel gears which speed up the rollers on the type of table now being analyzed. This gives a slight increase in the pitch cone radius and therefore a little more face width. As mentioned previously, it is virtually impossible to measure the impact load to which these

Figure 2 — With the mill table roller bearing mounted in the bed plate, removal of the roller is more difficult than with the design of Figure 1.



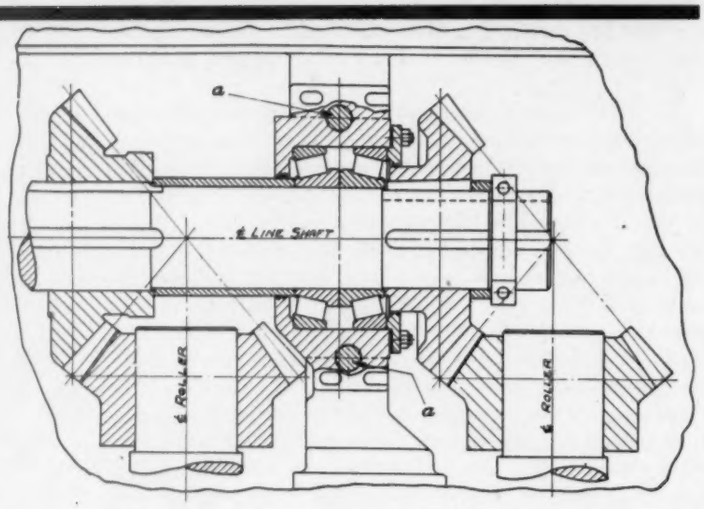


Figure 3 — Section through line shaft thrust bearing assembly.

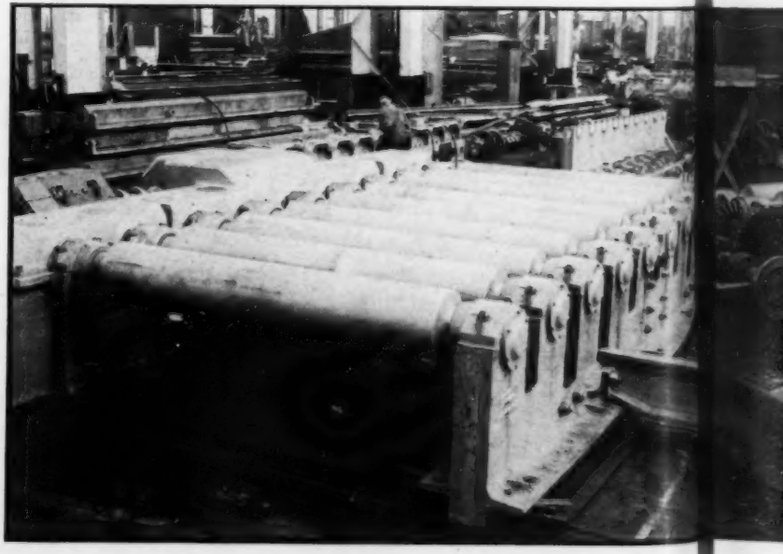
gears are subjected. Two other factors must also be considered: the shock of quick reversal and the possibility of misalignment due to roller distortion, which may result from impact or heat warpage. Neither the science of machine design nor that of metallurgy has produced anything which will stand up indefinitely under such conditions. In other words, to use an honored and appropriate expression, "they are expendable." The ideal gear would be highly shock resistant, would present a very hard surface for wear, would present a very accurately cut surface for bearing area, and would limit this area in such a way that at no time would the entire load be concentrated at the ends of any tooth. A high degree of excellence in one of these qualities militates against the others. Therefore, any selected gear will be a compromise in one way or another. A low carbon chrome, nickel, molybdenum forging (SAE 4340), quenched and heat treated before machining to about 240 to 300 Brinell will give a shock-resistant gear with a uniform core strength and a high percentage of contact area. A low carbon alloy which can be carburized to 450 Brinell or over has excellent wearing qualities, but being rather brittle through the area of case hardening, is more susceptible to tooth breakage. It must also be machined before heat treating, and the subsequent distortion does not permit as much contact area between teeth, causing localized stresses and unpredictable breakage. Sometimes drawing back to 350 to 400 Brinell helps by giving the hardened section higher ductility. Increased strength cannot be acquired by increasing the face, which should never exceed one third the pitch cone radius. Extreme care must be exercised to guard against heat treating cracks. Photoelastic analyses have shown extremely high stress concentrations around these cracks. When they become filled with oil and load is applied, hydraulic pressure is developed, further extending them.

Impact loads are somewhat absorbed before they reach the drive. However, the mill type motors in use today can develop starting torques which are four to five times normal running torque and the drives must be designed accordingly. They are usually double reduction. The motor pinion is made of alloy forged steel, heat treated before machining to a hardness consistent with accurate machine work. The motor gear is 0.40 to 0.50 per cent carbon cast steel or alloy, depending on the loads. Both have double helical generated continuous teeth with a 30 degree helix angle. Multiplicity of tooth engagement and overlap give a quiet and smooth operation with good distribution of any shock loads. The second reduction is always made with spur gears because of the necessity for moving the line shaft across the face of the intermediate pinion to disengage the roller bevel gears. With proper maintenance, a well designed drive should last indefinitely because tooth wear is the governing factor rather than breakage.

The girders and bed plates are made of 0.25 to 0.35 per cent carbon cast steel. There is no particular requirement as to their length, but 8 to 12 ft is fairly representative. Each bed plate is tied to the opposite girder by at least two heavy steel bolts with cast iron separators acting as spacers. Each girder and bed plate is keyed to the adjacent one to preserve alignment. The section next to the mill must have large base areas or be provided with heavy sole plates to distribute the load over the foundation, or the pounding will shatter the concrete. This in turn will have a destructive effect on bearings and gears. Bearing caps and gear covers are also made of cast steel. Inspection holes are located over the mesh points of all gears. The lids are gasketed and bolted to the covers to prevent the entrance of water and oil leakage. Points where cover sections meet are sealed by overlapping joint plates and jute packing.

It was formerly the practice to incorporate the feed rollers with the table and drive them from the same line shaft. This did not prove successful, as the impact loads went through the entire system, wrecking bearings and gears. The roller body was then made independent of the shaft, rotating about it on sleeve bearings, the shaft being driven as before. This served to eliminate a great part of the shock, but trouble was experienced

Figure 4 — Delivery side of reversing mill table is shown set up in the shop.



reversing and re-entering the mill. The free roller did not have enough traction to force the piece into the bite of the rolls. Operators purposely then left the sleeves run dry with the result that the original condition existed again, a positive drive from the line shaft. Feed rollers are now installed as a separate unit with separate heavy duty drives. On some smaller mills, friction clutches have been installed, but this has not been attempted on heavy mills.

As with practically all other machines or machine elements, lubrication is the key to economical and trouble free operation. Its success or failure is reflected in down time, maintenance and power cost, and replacement of parts. Mention has already been made of the lubrication of the table roller bearings. The same holds true for those in the line shaft and drive. On new installations, these are always greased by a central pressure system either manual or motor operated. It has not been too many years since the practical application of the science of lubrication with respect to steel mill tables consisted in applying with a paddle, the cheapest gear shield that could be purchased. This was done when the spirit moved some maintenance man, possibly during down time or when the roller saw fit to stop operation long enough to permit it. Much has been learned since then, some of it the hard way. We now have totally enclosed gears and the job of the maintenance man is less laborious, though it requires a higher degree of skill.

With enclosed gears, there are two systems available for lubrication, splash and combined splash and circulation. Because of the presence of heat and water, the latter is a necessity, but before discussing it, a few points about the oil it handles should be considered. Three characteristics of the oil are of prime importance: its viscosity at the operating temperature, resistance to oxidation, and demulsification characteristics. It is well known that viscosity varies with temperature. From his experience, the designer can anticipate with a fair degree of accuracy what temperatures are to be encountered, and knowing also the speed range and nature of the loads he can specify the viscosity accordingly. At high speed a large amount of oil is drawn into the pressure area between teeth and there is but a short time to squeeze it out. Therefore, an oil with low viscosity is suitable. At low speeds the converse is true. Heavy and shock loads tend to rupture the lubricating film and light steady loads do not. Heavy oils require more power input for the same speed because of their internal friction. These factors must be combined and the viscosity as finally determined should be high enough to preserve the film and low enough to avoid needless power loss.

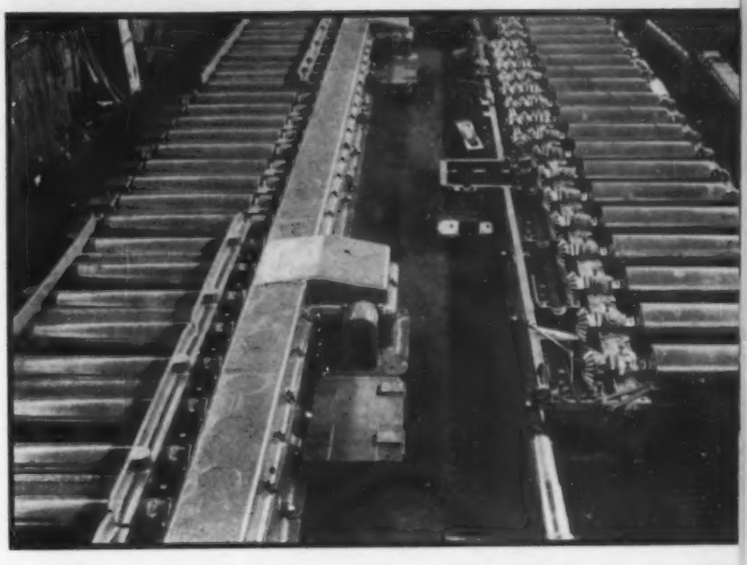
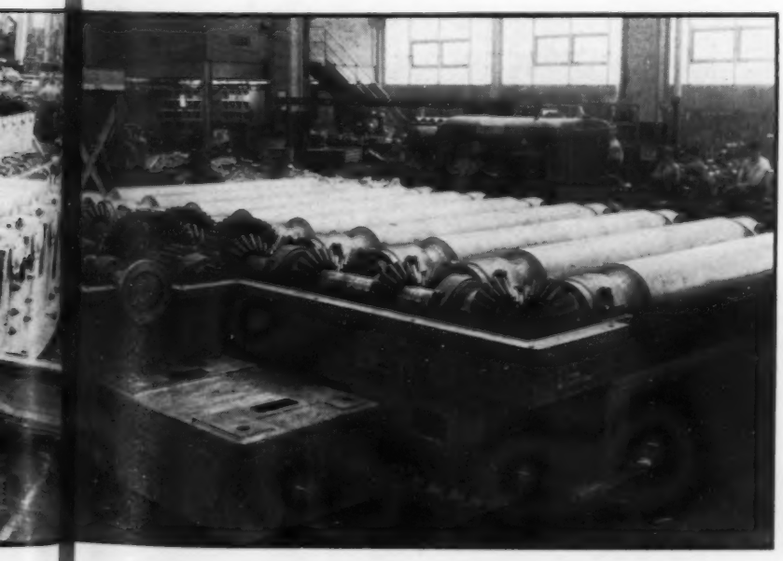


Figure 6 — The lighter construction of strip mill tables as compared with blooming mill tables is here illustrated.

Figure 5 — Line shaft side of mill table shown in Figure 4, with covers removed to show gearing and drive.



The violent churning action of the gears generates heat and breaks the oil into a fine mist or spray; in this condition, it is susceptible to oxidation with the result that acidity is increased and sludge forms. The lubricating qualities are then adversely affected and the sludge collects in the bottom of the gear case, clogs the drain lines, coats the cooling coils, and in general decreases the efficiency of the unit. Therefore, it is necessary to select an oil that is chemically stable in the operating temperature range.

Regardless of how perfectly the mechanical seals function, water is continually getting into the gear cases in the form of atmospheric moisture. The amount varies with the weather, but is quite large in the winter when the mill is down after operating at high temperature. Its effect is to rust gear and bearing surfaces and accelerate oil deterioration. Water does not separate readily from oxidized oil, but forms a permanent emulsion with consequent decrease in lubricating efficiency and formation of sludge deposits. Therefore, in addition to the proper viscosity and chemical stability, the oil must have a high demulsibility factor or in other words, it must separate quickly from water.

The requirements of a circulating system are a supply reservoir, pumps, heating and cooling units, filters, centrifuge, supply and drain piping, and an alarm system. The supply reservoir should hold about twenty

Figure 7 — Runout table shown has individual motor drives.

minutes pumping capacity, be equipped with steam coils for heating, a liquid level gauge, drains at the bottom for drawing off water, and access connections for a portable centrifuge. It should be low enough that the return lines will have a fall of about 3 in. in 10 ft and should be well vented. The pump connections must be sufficiently high to avoid drawing in water and sediment. One pump more than actually needed should be available for a standby. Flow should be controllable through variable volume pumps or a system of valves and by-passes. There should be a filter between the pumps and table. When a cooling unit is necessary, it should be located after the filter. By-passes are provided at the table return lines so the height of oil in the gear case can be controlled. If it is too high, there is excessive churning, thus generating heat and causing a power loss. If too low all the wearing surfaces are not lubricated. Where bevel gears are used, there is a tendency for oil to build up to one end of the case. This is overcome by baffling which retards the flow. Drain lines should be well vented. Temperature gauges are located on the supply tank and at the exit end of the cooler. Alarm signals can be located in the operator's pulpit and the oil cellar. They should sound if the filter becomes clogged or the pressure falls too low. A light should be located in the pulpit so the operator will know that the system is functioning. In order that excessive churning does not take place, oil pans are placed around the lower halves of high speed motor gears, their tops projecting above the oil level. A suitable intake regulates flow and the remainder of the oil in the case is not agitated.

Motor selection for front and back tables is not a difficult problem, but it is unusual because the motors do no useful work. They overcome inertia and friction forces, but do nothing to alter the shape of the ingot nor do they raise it against the force of gravity. Mill type motors are always used, having been specially designed for this service. They are of rugged construction, well protected against water and dirt, have strong shafts, anti-friction bearings, and small diameter armatures which give low inertia values and make quick reversal easier. Direct current is used because of the wide range of speed control possible, ease of obtaining dynamic braking, and the high starting torques developed.

Motor output has both mechanical and thermal limitations. Mechanically it can deliver only so much torque, dependent on the maximum current that can be commutated. Starting, stopping, and reversing represent the biggest demands on the motor. The maximum starting torque of a mill type motor can be as much as five times the normal running torque, which is a great aid in rapid acceleration. The importance of this lies in the fact that production is going on only while the steel is between the mill rolls, so a decrease in acceleration time means an increase in percentage of productive time. The ability of a motor to accelerate can be measured by calculating the inertia and friction forces it must overcome and comparing them with the torque. The term WR^2 represents the inertia force. It is the weight of any rotating element in the table, times its radius of gyration squared about its axis of rotation. For ease in handling, these values are all converted to the motor shaft by dividing the WR^2 of each element by the square of the speed ratio between the motor and itself. The ingot too must be considered, keeping in mind that the accelerating force cannot exceed the tangential frictional force between ingot and roller. Should no slippage occur, it accelerates with the rest of the system, and since its motion is linear, its equivalent WR^2 at the motor shaft equals $W\left(\frac{V}{2\pi N}\right)^2$

where:

W = weight of ingot.
V = velocity in feet per minute attained by ingot.
N = motor speed in rpm.

The accelerating torque $T = \frac{WR^2N}{308t}$ where

t = time in seconds of acceleration from zero to N.
WR^2 = total for the system including ingot, referred to motor.
T = motor starting torque in foot pounds.

In going through such a set of calculations, it will often be found that the motor armature contributes a large percentage of the total inertia. When this condition exists, there is a point beyond which increasing motor size to speed up acceleration is uneconomical and operates according to the law of diminishing returns. Sometimes two smaller motors having equal capacity but less WR^2 than one large motor are used to alleviate this.

The thermal limitations of a motor are based on how much heat the insulation can withstand. The heat loss equals I^2R or in other words, the heat generated in the conductors varies as the square of the current. The torque is also proportional to the current which reaches its peak during starting. The frequent starting therefore imposes more load than normal running, and it is necessary to select a motor with a rating safely above the average of the duty cycle. The average is determined by the root-mean-square method, which consists in taking the square root of the average I^2 times the

time for the cycle. However, the horsepower is proportional to current input, and since motors are rated in horsepower rather than amperes, the root-mean-square horsepower is used. The time of the cycle is the interval between the positioning of two successive ingots on the entry table.

This is actually an over-simplification of the picture as no consideration has been given to some of the governing factors; for example, the type of control used, but it serves to illustrate the procedure used. Several excellent and detailed papers have been given on the same subject from an electrical standpoint. Tables reverse direction with the mill rolls and match their peripheral speed as closely as possible. On the most recent installations, Ward-Leonard control has been used, being superior to magnetic control from an operating standpoint because of fast, smooth acceleration, the absence of current peaks during starting, and excellent speed control.

Figures 4 and 5 are typical illustrations of the units just described. The remaining tables in the blooming and slabbing mill setup do not receive the severe usage accorded the front and back tables, and consequently are not made so heavily. While the rollers are forged they are generally smaller in diameter. The circulating system is maintained for lubrication up to and including the first section beyond the shear, because heat is still a problem. It is sometimes necessary for the mill approach and runout tables to reverse with the front and back tables, but this occurs only for the last few passes on long sections. Otherwise, it occurs only when spotting the ingot or slab for shearing, weighing, marking, etc., or when running it back and forth slowly to prevent roller warpage during delay periods. In any event neither reversal nor acceleration need be fast, so motor size can be cut down. Magnetic control is used rather than variable voltage. The general structural features are the same, though bearing sizes can be reduced and alloy and heat treat specifications can be modified.

Plate and strip mill tables, and in fact all line shaft driven tables, are similar to those just described, but as the loading is decreased, the construction is made lighter. Shell type rollers of cast steel, centrifugally cast iron or seamless tube, spaced from 24 to 48 in. are used. With wide spacing, cast iron aprons between the rollers act as supports and guides without scratching the material. For intermediate or light duty, heavy cast girders and bedplates are replaced by individual mitre boxes and rolled structural sections at a considerable saving to the customer. Rapid acceleration and reversal are seldom necessary, so smaller motors are selected. Control is almost universally magnetic. Figure 6 is a shop view of some typical strip mill tables.

Some of the less common features are also worthy of mention. Broadsiding can be done by driving alternate rollers from opposite sides of the table and in opposite directions. Such rollers have tapered bodies and are driven from the large end.

When small slabs are used, the necessary close roller spacing is obtained by using disc type rollers and driving alternate ones from opposite sides. The discs may be cut from a plate and welded to forged steel shafts or may be cast integral with the shaft. To facilitate marking, inspection and layout work, plates should be reasonably cool, and disc tables which permit circulation of air underneath the plate have proven very suitable

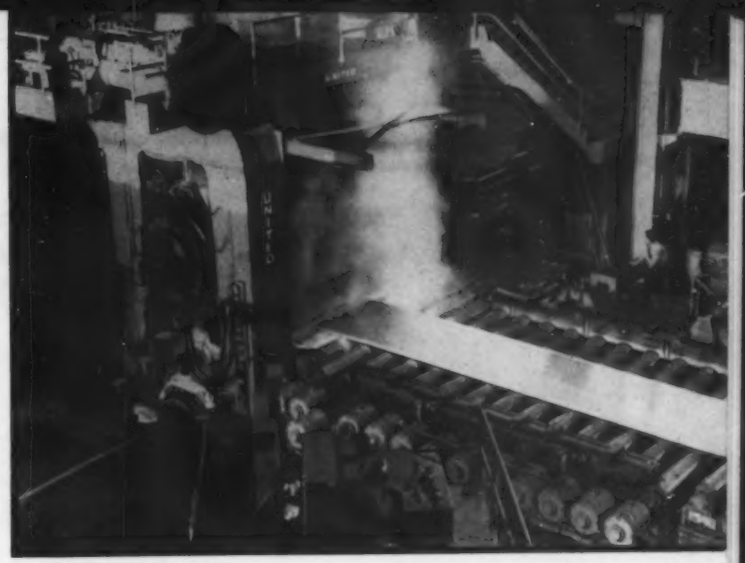


Figure 8 — 112 in. four-high, reversing aluminum mill shown has individually driven rollers throughout. Rollers have a double taper.

for this purpose. Roller chain conveyors have also been used as plate cooling tables.

Tilting tables at three-high mills and depressing tables at shears are functionally the same as their stationary counterparts except that with enclosed drives, the gear lubricant is a semi-fluid gear shield piped to each mesh point from a central station. They are provided with an electric or hydraulic tilting mechanism, pivot point, and counterweight. Shear depressing tables are sometimes connected to the moving knife head.

Individually driven rollers have their most common application in hot runout tables, though they are also used on curved tables and where space requirements do not permit line shaft installations. There are a number of very definite advantages inherent in their use, notably, simplified lubrication, weight and space economy, less mechanical maintenance and less down time in case of a failure. Roller design is based on the same factors that apply elsewhere with one exception, care must be taken that the rollers are in balance. Unbalance in line shaft tables can be minimized by turning the rollers about their own axes so that the displaced centers of gravity will not be at the low point simultaneously. With a single roller, good balance is essential to prevent excessive mechanical deterioration.

Most of the runout table motors in use today are a-c, ranging from ½ to 10 hp. Speed control is by variable frequency. The d-c systems are variable voltage control and have been gaining favor in recent years. Figure 7 shows a typical runout table.

During the war an aluminum hot strip mill was installed, equipped throughout with individually driven rollers. Figure 8 shows the 112 in. 4-high reversing, roughing stand and tables. The rollers have a double taper which serves to center the strip and supports it at only two points, thus preventing scratching. This unit has been operating very successfully. At the present time, preliminary studies are in progress to determine the advisability of replacing the front and back tables of a slabbing mill with individually driven rollers. These have not advanced far enough to justify much comment.

Of necessity, this paper has been limited to touching a few of the high spots in table design, but perhaps it will indicate some of the problems facing equipment manufacturers and users of this type of equipment.

Production Planning - -

. . . . proper planning and scheduling can promote economies by keeping units operating at maximum capacity rates . . . . such planning also aids in delivering customers' orders on schedule . . . .

by John F. Black

ASSISTANT WORKS MANAGER

ATLAS STEELS LIMITED

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▲ PRODUCTION planning has as its object the expeditious handling of customer's orders using the most economical means available, and is very essential in any industry where the sequence of operations is varied and complex. These production plans must take into consideration what is to be manufactured, when it is to be manufactured and the methods to be used. Smoother and more economic mill operation can be assured if plans based on known production factors are accurately prepared and effectively used.

Production planning may be carried on at one or two levels depending on the size and nature of the operations. A central planning or order office may be all that is required where operations follow a simple straight line sequence. In this case, it is usually sufficient to schedule the main operating unit such as the rolling mill and have the subsequent operations accommodate the mill. However, both central planning and departmental planning divisions are found to be necessary in the case of larger plants manufacturing a wide range of products requiring more complex treatment. It is production planning as related to this latter type of mill that is being considered in this paper.

CENTRAL PLANNING

The function of the central planning department is to convert sales orders into manufacturing orders and to set promise dates for delivery of steel to customers. This department issues the manufacturing orders to the plant along with the operating schedules which are drawn up as far in advance as possible, generally on a weekly basis. Central planning determines the rolling cycles for the mills which is based on back log of orders and business forecast as supplied by sales department.

The central planning organization is composed of a head planner, over five central planners, each responsible for scheduling one or more major divisions of the operations such as melting, rolling mills, hammers, finishing, etc. The size of the operation determines how many of these major operating units can be conveniently scheduled by one planner. It is their responsibility to set up the forward schedules, keep load charts, and to determine the length of time required to produce steels of different grades and dimensions. Using standard planning times or production factors and standard processing procedures, the central planner draws up a work order or manufacturing order showing the proper sequence of operations and the time required to do each operation. Then consulting his load charts he sets down the starting date of each operation shown on the manufacturing order.

Keeping accurate load charts for all operating units is an important phase of central planning. Before giving a promise date on a new order, the load charts for all operations through which this item would pass must be consulted. The operation having the greatest number of days' work ahead would of course determine the best promise date that normally would be given. The works manager is particularly interested in these load charts as they enable him to anticipate his personnel and supply requirements for the coming week or month.

DEPARTMENTAL PLANNING

Once the orders and schedules are issued to the plant it is sometimes found that the central planning office cannot follow through with the highest efficiency on the schedules that it prepares. Its authority does not extend into the plant. Also, the daily plant operations cannot, for various reasons, always follow the weekly schedule. Sometimes new orders come in and some of these may be added as amendments to the published schedules; or orders may be cancelled. Orders may be rushed through the plant out of sequence or on a shorter schedule than normal to relieve a customer in an emergency situation.

Such items should be closely controlled and kept to a minimum as they have a disruptive effect on the operating schedules in general.

Operating difficulties may occur which will sometimes require an immediate change in schedule in order to maintain smooth running operations.

What is needed is a means of carrying out the weekly or long range schedules in an orderly sequence. While central planning sets the general pace, some mechanism is needed to bring the general schedules down to daily operations which can and will be adhered to with an absolute minimum of deviation. Only by doing this can the delays that are caused by too many changes in sequence be eliminated. Department planning has been found to be a very effective method of taking care of the above requirements. It is a means by which customer's orders are guided through the various stages of manufacture promptly, economically and in such a manner as to insure the delivery of steel to the customer on the date promised. It is a function of the works management which supplements and assists the efforts of the operating foreman in his endeavor to plan and process orders according to schedule.

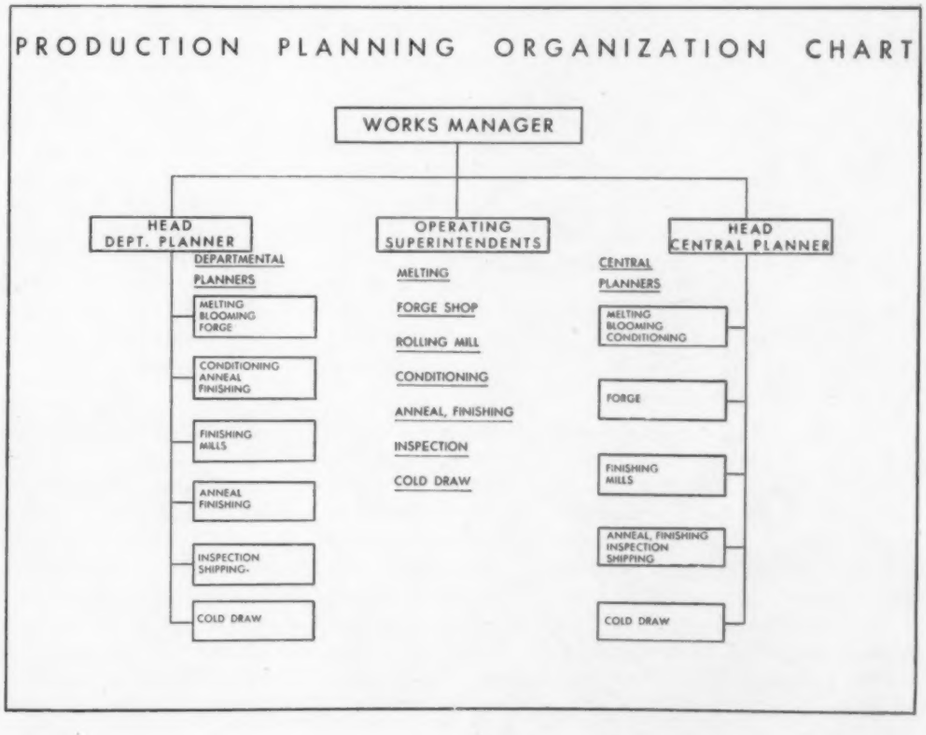
Departmental planning like central planning should have a planner for each major division of the operations or he may cover several operations depending upon the amount of work involved. The departmental planner's main function is to draw up a daily plan of work for each producing unit following as closely as possible the main operating schedules as issued by the central planning department. It is very important that close contact and cooperation be maintained between these two planning levels if the best results are to be obtained.

The departmental planning method needs proper setting up, care in selecting the personnel and unflagging supervision but will pay off if instituted and operated with a will to succeed. One of the first needs is to determine the operating time of the various operational steps involved from melting to finishing. This may be a matter of time study. The various grades of steel may vary somewhat in the number of hours and minutes required for melting, rolling, finishing, etc. The normal period for each grade should be established for all producing units. The resulting set of planning times or production factors are used by both the central and the departmental planners.

Since melting is the first operation in the sequence it is best to begin in that department. A man who is familiar with the operations and capable of setting up a schedule should be selected as a departmental planner to work with the melting foreman each day to lay out a daily work plan for each furnace. This plan will follow the weekly operating schedule as issued by the central planning department with such adjustments as are necessary to meet actual operating conditions for that day. The plan will show the sequence in which heats are to be melted as well as order number, heat number, grade, ingot size and approximate tapping time for each heat. A copy of this work plan should be sent to a departmental planner selected for the blooming mill and the forge so that he may know what steel he may expect to receive at the indicated time. This will enable him in turn to lay out the work to be done the following day by the various operating units in his department. If any changes are made in the melting schedule a change notice should be forwarded immediately to the mill and forge planner for his information. He may then adjust his own plans accordingly.

The departmental planner for the mill and forge departments receives copies of the work orders from the central planning department. These show the starting dates for each operation. The planner receives these orders each day and with the assistance of the foreman selects a sufficient number of orders for a day's work.

The organization described in this paper for planning production is outlined in this chart. Planners are staff men and have no authority to give orders to the operating men.



These are set down in the form of a detailed work plan showing the proper sequence, order number, grade, product size, etc. This plan is finally approved and signed by the foreman before it goes into the shop. It is then the responsibility of the foreman to see that operations are conducted according to this plan. Copies of the plan are sent forward to the departmental planner or planners of the conditioning and heat-treating departments, so that they may be on notice just what steel to expect from the mill and forge.

At the end of the day the departmental planners for the various departments will check the performance against the daily work plans. Any delays and deviations will be noted and all important delays will be reported to the works manager together with the reasons furnished by the foreman or his assistant and checked by the planner. It is this daily checking of work planned against work actually done which gives the works manager such close and positive control over production. Since the planning times used in drawing up the daily work plan are average figures based on previous operating performance, then failure to complete the daily plan of work would indicate an off-normal condition. This would be investigated immediately.

Departmental planners will be set up for all the remaining departments in the operational sequence, finishing mills and hammers, final heat-treating, straightening, cutting, etc., and inspection. The number will depend on how much ground one such planner can cover efficiently.

In selecting these men, care should be exercised to make sure they are men of initiative and action, with a good sense of coordination and team-work. They should be of sufficient stature to deal with foremen, general foremen and superintendents. Their pay should be high enough to permit advancement to foremanship as an easy next step in promotion.

These planners should meet daily so that their respective needs will be made known to each other. In this way each department can be brought to accommodate its operations to the needs of the department next in the sequence of operations.

Over them all should be a coordinator or chief departmental planner who should act as assistant to the works manager. He sees to it that the team-work is kept alive, that the departmental planners cover the ground daily, and resolves differences of opinion among them. He also sees that the proper relations are maintained with the foremen and superintendents, and reports to the works manager all important delays. He studies the operations from a time angle with a view to improvement and keeps his superior informed of all phases of operation that require his attention.

To assure the expeditious supply of billet stock to the mill when orders are filled from such stock, the stockkeepers are also brought into this system. To avoid delay in locating the desired billets, the stock should be neatly stacked by grades and sizes, with heat numbers conspicuously painted or stamped on each billet. The requirements of the mill or forge should be furnished to the foreman of the billet shed about twenty-four hours ahead of time so that the billets can be transferred in time for use. It is desirable to accompany each transfer with a transfer slip, showing order number and number of billets, to be signed on delivery by the mill and forge and returned immediately to billet office.

The chief departmental planner and his team of departmental planners may be looked upon as the works manager's active participation in the detailed operations of the plant, but should not be regarded as diminishing the authority and responsibilities of the superintendents and foremen. This team is rather a means of assuring that the work goes according to schedule and that the works manager has a direct access to delays and their causes. The purpose is to bring the weekly schedule prepared by central planning into a smooth-running sequence of daily operations, and to avoid delays or to report them immediately down the line so that schedules may be modified accordingly and further delays thus avoided. The chief departmental planner is in daily touch with the works manager and represents his authority in a staff but not a line capacity. He gives no orders to the foremen or superintendents but may affect their activities through his superior.

There are several benefits to be derived from this staff of departmental planners operating within the plant.

1. Customer service is greatly improved.
2. Producing units are kept loaded to capacity thus favoring lower unit operating costs.
3. Better coordination of operations between the various departments.
4. Closer supervision of operations by foreman since he is relieved of much detail work.
5. Lower cost of direct supervision since foreman can cover more operations.
6. Adherence to standard operating procedures is assured thus giving greater quality control.
7. Works management is kept in closer touch with the day to day operations.

It is essential, of course, that the central planning department work closely with the departmental planners. All changes in schedules should be cleared through them and the foremen; and the latter should not change a schedule without informing the departmental planner, whose responsibility it is to see that the changes are made known to those affected by them, without delay. This is a function that foremen, who are more concerned with their own immediate operations, sometimes do not perform with the desired promptness and efficiency. The departmental planner is sensitized to the effects of unreported changes and is in the best position to communicate changes and delays to the departments affected. The foreman is often otherwise engaged and may forget to report or may not appreciate the necessity of doing so.

The possibilities of delays, of relaxation of vigilance and the adoption of irregular practices are so constant and so strong throughout the operations that the continued need of a live and wide-awake team of planners and coordinators, who are in a position to view the operations daily, and who are in daily touch with the supervisors and acquainted with their problems no less than their attitudes, is fully assured. In this team, the works manager has a mechanism for both efficiency and drive, and by keeping his eye on it and maintaining a lively interest in their activities may be sure that no grass will grow under his feet.

Mechanized Coal Mining

With the recent shortages of coal, and interest in coal supply, a set of new pictures depicting the various steps in mechanized bituminous coal mining, is of current interest. These photographs were taken at the Leisenring No. 2 mine of the H. C. Frick Coke Company, Pennsylvania coal subsidiary of United States Steel Corporation, near Uniontown, Pennsylvania.

Basically, the steps in mechanized coal mining are as follows: machine cutting the coal to obtain a greater tonnage per blast; machine drilling the holes in the face of the coal which will hold the blasting charge; "shooting" the coal with a specially prepared and approved blasting powder; loading the coal with electric-driven loading machines into mine cars.

Coal produced at this mine is of metallurgical grade and is used in steelmaking by other U. S. Steel Subsidiaries.

Top cutting into rich Pittsburgh vein of bituminous coal is a universal cutting machine which slices nine feet deep into thick deposit in this first step of modern mining. Machines operate at all angles, are used to cut top, bottom and sides; are handled by two men, machine runner and helper. Runners become very adept in handling them, so much so that it has often been jokingly said that operators can cut their initials into the face of the coal. The helper, pictured observing cut, wears U. S. Bureau of Mines approved cap lamp with battery attached to his belt.

The "shooting" is over, and big, black chunks of coal, loosened from the mine's face, lie ready for the mechanized loading equipment to go to work. Some of the coal that is still intact will fall loose and be loaded after the tonnage on the floor is removed. Fire boss checks for gas and safe roof with safety lamp and sounding stick.

Drilling into the "face" of the coal vein with an electrically-driven machine is another important step in mechanized coal mining. The face is where the coal is cut and loaded. The machine is operated by a highly-skilled machine "runner" and helper. In the picture, the runner has his left hand on lever, ready to start drilling into vein. Several holes are drilled into face later to be charged with sticks of blasting powder, which break the coal loose from the roof and floor. Explosives used are U. S. Bureau of Mines approved, and will not ignite mine gases.

"Shooting" the coal follows drilling, but first the charge must be set. Several powder sticks are pushed into the hole drilled in the coal seam, then "shot firer" inserts electric blasting cap in last stick of explosive. Sticks are pushed deep into vein to break loose big section of coal. Shot firer is highly-skilled man of many years experience in the mines, and is certified by the state to perform this exacting job. Suspended from his belt is safety lamp, used to detect gases and oxygen deficiency. Under lock and key, he carries detonator caps safely in leather knapsack over his shoulder.

After "shooting," the loading machine moves in to start coal on its way to important steelmaking use. Coal is drawn on conveyor by steel bits on two chains revolving at front of machine. Electric-driven loading machines and other mechanized equipment speed coal output.

Double lane of loaded coal cars are being moved to shaft bottom. Cars are hoisted to tipple by elevator. Workman on rear car operates brakes.

Forging Operations

. . . . the ease of forging a particular part depends on the relation of the section balance to the natural flow of the metal during forging . . . .

by J. A. Over

CHIEF METALLURGIST

J. A. WILLIAMS AND COMPANY

BUFFALO, NEW YORK

▲ MODERN forging operations are a descendant of the blacksmith. Where the blacksmith controlled the flow of metal by a hand hammer and later a power hammer, today's operations put the metal into intricate shapes by the use of dies. We can break up present day operations into various methods. Hammer forging either open frame or closed frame, gravity drop hammers, or steam power hammers, press forgings, upsetter forging or forging machines, forging rolls, and trip hammers.

In an effort to be brief, the scope of this paper will be limited to basic considerations of hammer forging of steel.

The drop-forging industry produces a wide variety of parts, the number of which has been estimated at 500,000 different forgings. Most of the parts are a variation of a few fundamental shapes such as, forms of discs and crosses, bars with raised bosses, forms of Y, L, T, H and U shapes, all with a variety of standard cross sections. The ease with which a part may be fabricated depends upon the section balance in relation to the natural flow of the metal during forging. Many forge shops specialize in the forging of certain difficult shapes, and certain shapes may be classified as difficult by one shop, while another may have the necessary equipment and consider the same part, a conventional forging.

The dies which control the metal flow in a hammer are made either as an open die which is a plane surface die where various parts of the forging are progressively worked, or as a closed die containing recessed impressions where all surfaces are worked at the same time and thereby facilitate the manufacture of forgings to close tolerances. A pair of closed hammer dies is required to produce a forging since each die forms a part of the forging.

Many closed hammer dies are made so that equal volumes of metal are at each side of the parting line and therefore the dies can be parted in one plane. Very often the nature of the forging to be produced makes it impossible to use a simple one plane die, and two or more planes must be used. It is always advantageous to use a one plane die if possible

When a die must be made using one change of plane, it is termed a locked die, and if it has more than one change of plane it is called a compound locked die. When dies having a change of plane are used, a side thrust occurs on surfaces that are not at right angles to the motion of the hammer and this can be compensated for by the use of counter die locks if necessary.

The closed die always includes a finishing impression, and may include one or more of the following impressions, fuller, edger, roller and blocker. The closed die also may have provision for bending the stock. The "fullering" of the stock produces the approximate length and reduces the cross section where desired. The function of the edger is to distribute or collect the volume of metal necessary to fill the blocker. Rolling is used when a circular cross section of the stock is desired. When the axis of the forging is in more than one direction like a crankshaft, it is necessary to bend the stock on the die to coincide with the desired direction. In the blocker, the forging takes a shape similar to the finished part and contains more volume than the finished forging. The excess flash or metal begins to flow out from the edges of the impression and between the dies into an area termed the gutter. The forging is then transferred to the finisher where the final shape is formed by bringing the dies closer together by successive blows. An allowance for die closure must be made which varies from —0.008 to +0.024 in. for a ¼ lb forging to —0.058 to +0.174 in. for a 100 lb forging; however, these tolerances can be held smaller by special care. The removal of the flash is sometimes necessary after the blocking operation, and is always removed by a press after the forging is finished.

Allowance must be made over required dimensions for draft angle to facilitate removal of forging from the die. The usual angle is 7 degrees for drop-forgings, however, presses can use 3 degrees or even less. Allowance must also be made for decarburization of about

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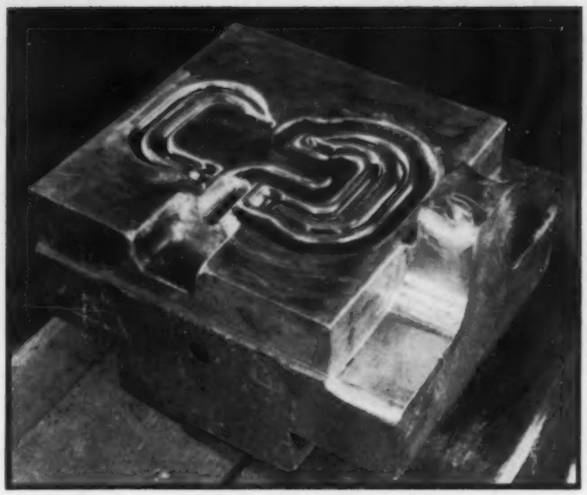


Figure 1 — This example of a closed die has the following impressions from left to right, blanker, finisher and provision for bending.

1/16 in. for a surface. The decarburization does not necessarily have to be removed by machining except where surface hardness is important, however, in the design of a forging based upon strength for a given cross section it must be taken into consideration.

Hammers are rated by the dropping weight, and in the case of a gravity drop, by the weight of the ram. Gravity drop hammers range from 400 to 7,500 lb. Steam hammers are rated by the weight of the ram, piston and piston rod, and usually range from 400 to 35,000 lb. The work done per blow can be computed from the energy equation $P = W \times H$ for a gravity drop hammer. For the power hammer this becomes

$$P = \frac{WV^2}{2g}$$ where:

W = Rated falling weight.
P = Work in ft lb.
V = Velocity of falling weight at moment of impact.
H = Height in feet.
g = Acceleration due to gravity.

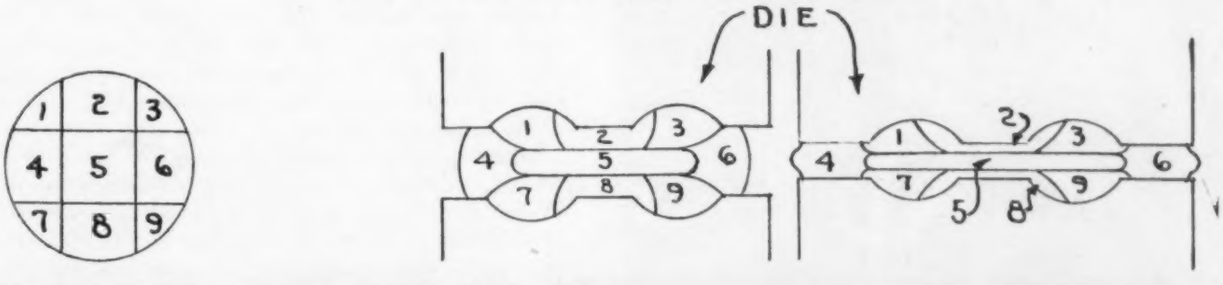
The fundamental force produced in forging is compression. However, torsion, bending, and extrusion may also be produced. The reaction to these forces under a hammer can be called plastic deformation of the material being forged. In the case of steel, the force resisting the deformation can be gauged from the tensile properties of the steel at forging temperatures of 2000 to 2400 F, which indicate the tensile strength at 2000 to 6000 psi depending upon analysis. This does not mean, however, that for a given cross section, the above may be used to directly compute the force required to fabricate a forging since the shape and volume change are also factors. Power used in the forging operation to work the metal is converted to heat, and this heat increases the temperature of the forging or is carried away by the mass of the die and surrounding atmosphere. Attempts to measure the heat transmitted to a forging of steel are rather difficult to perform, but we have successfully measured the heat transmitted to an aluminum forging by using a contact pyrometer and noting the increase in temperature after the aluminum had been subjected to various amounts of reduction. In general, a temperature increase in excess of 100 F with a starting temperature of 750 F have been measured after the fabrication of an aluminum forging requiring considerable reduction.

Impact energy of the sharp blows from a drop hammer is resisted by plastic deformation of the metal and is also, in part, carried to the hammer frame and foundations. The greatest amount of energy transmitted to the metal being forged is transmitted to the outer section of the forging, since the impact energy is the greatest at the first point of contact. As a result, light blows are only capable of working the surface layers, leaving the center almost unaffected. Selection of equipment capable of producing a properly forged part therefore becomes important. Attempts to assimilate data have to date resulted only in empirical relations, and knowledge gained from experience is the rule in determining equipment to be used.

The mechanism of deformation is one of crystal orientation. Most plastic metals and alloys have face centered cubic structures such as copper, aluminum, nickel, lead, and gold. Zinc and magnesium have hexagonal structures and deform along the basal plane most readily. Iron or steel is body centered; however upon heating through the critical transformation range, the structure becomes face centered above 1500 to 1600 F.

The most easily deformed is the face centered crystal. Deformation takes place by slip along a plane of the sides of the crystal and by mechanical twinning. The

Figure 2 — The metal flow of each section of a round bar under the die, when forged, is shown by this sketch.



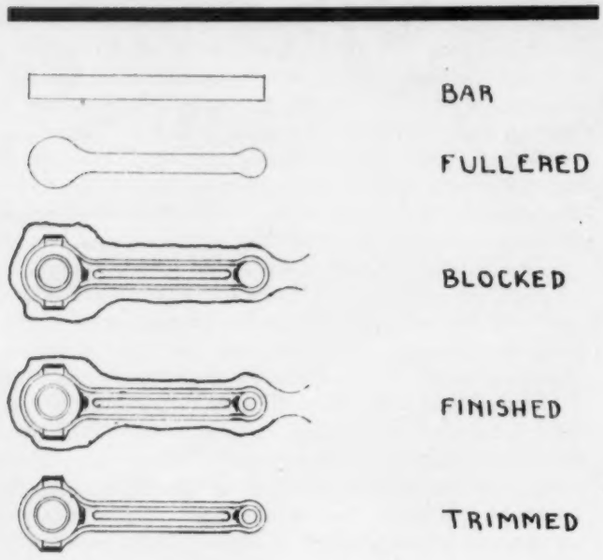
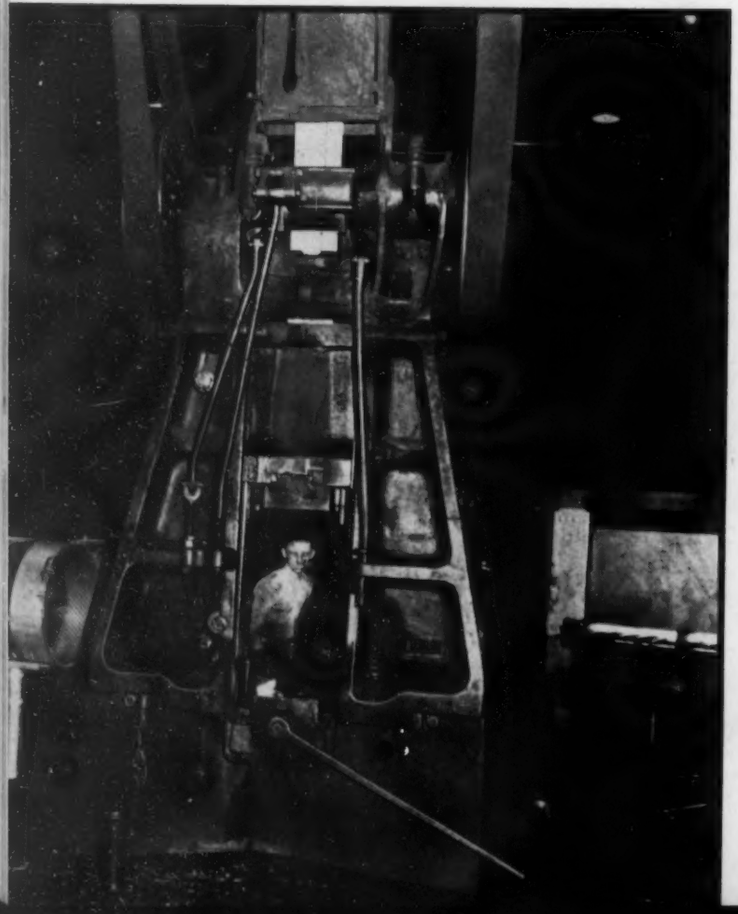


Figure 3 — The steps in forging a typical connecting rod are sketched in this figure.

deformation characteristics are fixed for a given crystal structure.

During the heating of the material prior to forging, it is important to render the material into a plastic state and at the same time not produce a detrimental effect upon the material. Grain growth, in the case of steel, which occurs when the steel is heated to temperatures above the upper critical, can become serious from too long a period of time at forging temperature or from too high a temperature, and can result in a so-called "burnt" forging, or it may produce low physical properties in the finished part. If too short a soaking period is used and the steel is not heated through, the forging operation on the material can produce internal cracking or shattering. The proper temperatures and soaking periods vary for section and analysis of the steel.

Figure 4 — A typical gravity drop hammer.



The raw material from which closed die steel forgings are produced is invariably rolled bars or billets of square, round, or flat cross section. Blanks rolled to roughly approximate the shape of the required impression are used to some extent, but the use of cast blanks in closed die impressions is not a part of the forging art.

The mechanism of what happens to a bar of steel when it is deformed under a hammer can be illustrated diagrammatically by taking a plane of cross section through a bar and considering numbered integral sections as they are progressively deformed as shown in Figure 2.

The progressive working of a bar by the various die impressions can be likewise simply illustrated by considering a connecting rod passing from fuller, blocker, finisher, and finally trimmed to remove excess flash, as illustrated in Figure 3.

The principal difference between the blocked and finished forging is not evident from the sketch since the radii of the corners cannot be seen in Figure 3. In the blocked forging, the radius is quite large to permit the initial shape breakdown and facilitate metal flow, while in the finished forging the radius can be made as small as desired.

The alignment or match of a pair of closed forging dies in the hammer must be reasonably perfect in order to produce a matched forging. In many cases, the blocking impression which usually performs the most breakdown, is on one side of the die with the finisher on the other, and since the impression is not in the direct center of the die, a tipping movement of the die impends when the metal is reduced in the blocker. Consequently the blocker is often put in the die with an intentional mismatch so that the blocked forging will be matched correctly. A bad mismatch carried through to the finished forging will result in a fold near the flash line or in a mismatched forging.

The scale formed upon the surface of the red hot bar of steel must be removed before forging. This is usually accomplished by bumping the bar on the edge of the die and then applying an air or steam blast directed at the face of the die. If the scale is not removed, it becomes forged into the metal and upon removal leaves a depression or pitting in the forging. In order to facilitate the removal of the hot forging from the die, oil is sometimes applied by swabbing to the surface of the impression. An excess of oil in a cavity will explode, thus leaving a feather-like appearance on the surface of the forging; or the explosion may even blow through a thin section rendering the forging useless.

The cooling of the finished forging becomes important in the case of steels that will air harden, and probably is most important in higher carbon steels. The stresses set up within the metal during forging will cause cracking to take place unless a slow cooling process is used;

Figure 5 — In this steam power hammer, a steam hose is being used to blow the scale from the face of the die.

and the easiest method at the forging hammer is to bury the forgings in spent charcoal or mica.

Steel used to produce sound forgings, which is important to the forging manufacturer as well as the ultimate user, must be of such quality that it can be subjected to proper forging technique and produce a sound product. As such it then becomes forging quality steel.

Two important prerequisites might be mentioned here. Obviously, any seams present in the bars will open up during the forging reduction. Also any undue non-metallic segregation near the center of the bar will be worked out into the flash area, or more commonly will be in the process of working out when the forging is finished. Thus, it leaves a crack or potential crack at the flash line.

The process of hot forging can be looked upon as a continuation of the advantageous working of metal produced in ingot form. In the cast ingot at a steel mill, the structure of the metal is dendritic. The rolling into billets and bars, required by the forging manufacturer, produces a grain flow such that the tensile strength is slightly greater, and the ductility, measured by elongation and reduction of area from a standard tensile test bar, is considerably greater in the direction of rolling.

The forging process takes full advantage of the grain flow and produces forgings with grain flow in the direction of the maximum stress that the finished part will encounter in service. A connecting rod, for example, will be forged from a bar so that the grain flow in the bar becomes the length of the rod. A gear is forged either by upsetting from a bar in an upsetting machine which flattens the end of a bar by reducing the length, or it can be made by pancaking a slug cut from a bar in a closed drop-hammer die. Both gears will have a radial grain flow such that the teeth of the finished gear will have maximum physical properties.

During the past 20 years, heat treatment of forgings has become universal and with the greater physical properties thus obtained, engineers desirous of even further increase in strength have specified the use of high hardenability alloy steels. Heat treatment of forgings is performed in accordance with standard practice with but one exception, the forgings must be held at the quenching temperature prior to quenching for a longer period than many heat treaters are accustomed to do. Many of the difficulties that arise with heat treated forgings can be eliminated by this one simple precaution.

The gratifying results that we have seen during the last war from our aircraft owe much of their origin to the designing engineer with his knowledge of the advantages and proper use of forgings. The modern, integrated, forging manufacturer has been able to meet the ever increasing requirements of the designing engineer during the war, and today with increased know-how, better equipment, technical control and supervision, and added facilities, looks to the future with confidence in its ability to produce the requirements of industry.

Remember the dates . . .

October 1, 2, 3 and 4, 1946

▲

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Radio Communication

IN SWITCH YARD OPERATIONS

. . . . radio communications for train operation extends as far back as 1924 . . . . however, the assignment in 1945 by the FCC of the 158 to 162 megacycle frequency band to railroad use permitted concentration on development and installation of equipment in approved bands . . . .

By G. H. Phelps

WESTINGHOUSE ELECTRIC CORPORATION

BALTIMORE, MARYLAND

▲ IN discussing radio communication as applied to switch yard operations, a review of the background of railroad radio's development will be helpful in clarifying the general picture.

The application of radio communication to moving trains is not new. It stems from the requirement of controlling a moving train. In the early history of railroads, control was exercised by means of time tables, various colored balls, wooden semaphores, and hand signals. Stories have frequently been told of the close calls and even wrecks caused by engineers doing their best to be the first train at the crossing or siding so they would not be delayed in their schedules. While these early systems were sometimes exciting, they did not make for safety in railroad travel. These early means of control have gradually evolved into the presently accepted methods of train control such as automatic block systems and centralized traffic control.

Telephone and telegraph dispatching between various control points supplement these control systems but even these means do not provide direct control of the train or switch engine. On the main line railroads, it is necessary to telephone the control point from which the track signal must be set or the train order delivered to the train. This is also true in switch yards even when telephone loudspeaker systems are used, since, in order to make actual two way contact with the engineer of the switch engine, it is necessary for him to go to a telephone call box or to the yardmaster's office in response to a summons from the loudspeaker system.

Since radio communication began, railroad men visualized its use as a direct means of communication with a moving train or locomotive. As far back as 1916, telegraph signals were transmitted by induction between a land station and a moving train. This system however was so delicate that it was not of practical operating use. When radio telephone communication became a reality, it was realized that this would provide a direct and flexible method of communication with and therefore control of moving trains. Since radio does not require any physical connection between the transmitting and receiving points, it can be placed on board the moving train where it is instantly available to the train crew. It is relatively independent of weather conditions since each unit can be made self-contained and not dependent on outside means for its operation. Thus, even though wire lines are prostrated by storms or floods, radio communication is still available for the transmission of required information. It is a flexible communication medium and although, since every railroad operates in a somewhat different manner, it can not fill every communication need, it can be applied to many different varieties of railroad communication requirements.

Various specific types of railroad operations would seem to lend themselves to the application of radio communication. This paper will discuss only its application to yard service in general, since other operations performed by main line railroads are outside the scope of this discussion.

Yard operations fall into two general classes, flat yards and hump yards. In a flat yard, trains are broken up and the individual cars classified into their different requirements as to destination or lading. Flat yards also serve as storage points for idle cars, interchange points between railroads and from them cars are taken to make up new trains. An industrial yard is a flat yard designed

Presented before AISE Pittsburgh District Section Meeting, January 14, 1946.

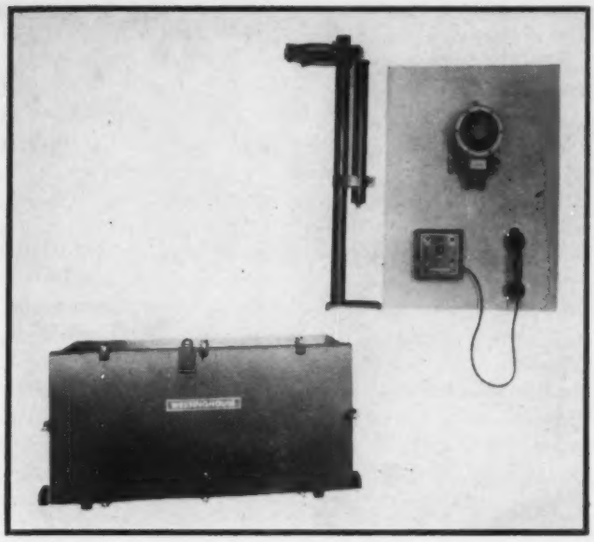
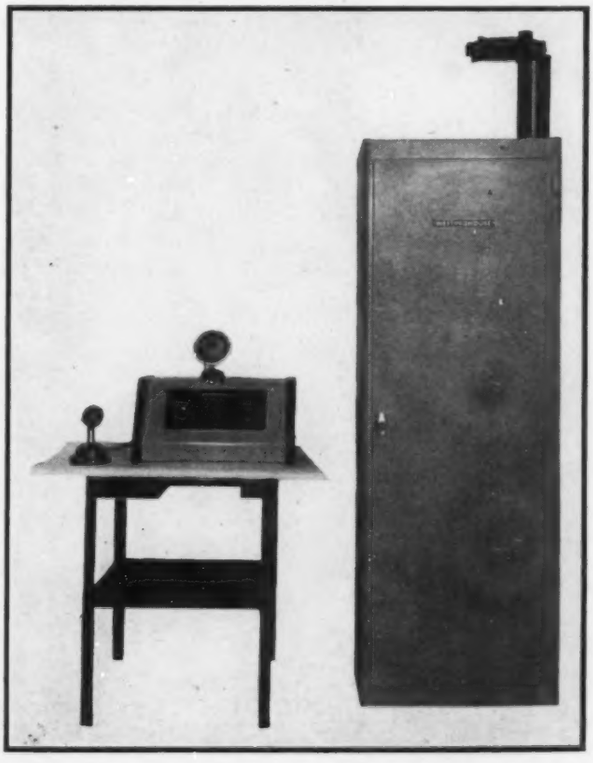


Figure 1 — The radio set shown can be used either in the locomotive or caboose.

to serve the particular needs of an industry. In addition to the above uses, an industrial yard also serves to connect the various plants of the industry by rail, so that heavy material and equipment can be moved between them or as a temporary storage point for heavy material during its manufacturing processes.

All of these movements require the service of switch locomotives. Under present conditions, movements of the locomotives are directed by written orders, telephone orders and hand signals. Under conditions of poor visibility, a great deal of time is wasted in transmitting to the locomotive engineers necessary orders to break up and classify or make up freight trains. Under any conditions, time is wasted while the engine crews go to a telephone or control tower for further orders.

Figure 2 — This set is used primarily in fixed stations



A hump yard is in reality, a classification yard wherein gravity is used to move the cars of a train to the various tracks as required. A long train is pushed over the hump by a switch locomotive and the cars are cut off and controlled by the men at the top of the hump. If a coupler fails to release and the cars are not disconnected from the train, the locomotive engineer must be told to stop until the difficulty is cleared. Under conditions of poor visibility this can be quite a time-consuming operation, and in addition, requires additional manpower.

Radio communication can provide rapid contact between the yardmaster and the engine crews for any type of yard. Switch engine crews can be prepared for the arrival of a train with a very short over-lapping of time, and no time will be lost by the switch engine crews having to call the yardmaster for instructions. In a hump yard, should any trouble arise at the hump, the yardmaster can notify the hump engine crew immediately so that the train can be stopped, the trouble cleared, and the engineer told to proceed. In the same manner, when the train is made up in an outgoing flat yard, the road engine can be immediately notified. The switch engine crews, having made up the train, can notify the yardmaster that they are free to undertake the next job.

Particularly in the case of an industrial switch yard, radio communication can play an important part. This is especially true in heavy industries where a locomotive is required to move material from one point to another. In a steel mill, for example, it may be found that ingots supposedly ready for processing are defective, and that unless a supply of suitable ingots is made available quickly, a costly shutdown may be necessary. It may take time to locate a switch engine to move the cars of defective material out and replace them with cars of suitable material, by the use of presently available telephone or loudspeaker systems. If the switch engines are radio equipped, it is only necessary to call the engine crews from the yard dispatcher's office, determine which engineer is nearest to the scene of trouble, and then direct him to proceed immediately with the necessary operations.

This same procedure can prove very valuable in case of fire or other emergencies. Because of the instantaneous availability of radio communication, switch engines can be quickly dispatched to the scene to pull cars loaded with valuable material to safety or to bring fire apparatus or other emergency service equipment to the scene. Since one or all of the locomotives available can be contacted, more than one operation may be directed simultaneously in order to best cope with whatever situation may arise.

While this paper has discussed the value of radio communication particularly in emergency circumstances, under normal operating conditions up to 25 per cent time saving may be realized. This is due to the greater use factor which can be obtained for each switch yard locomotive so equipped. This is the equivalent of an additional locomotive in so far as use is concerned, for

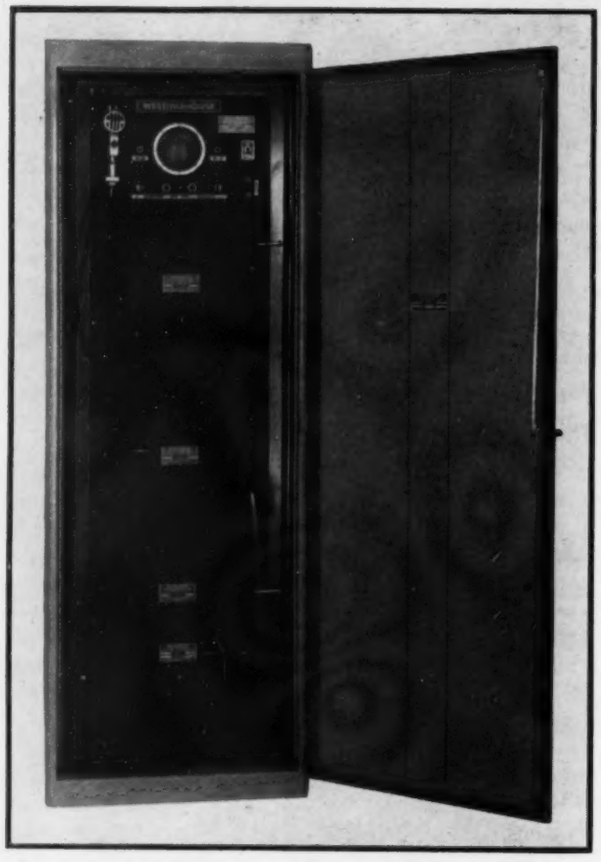


Figure 3 — Another view of the set in Figure 2 shows the working panel.

every four switch locomotives which are equipped with two way radio communication.

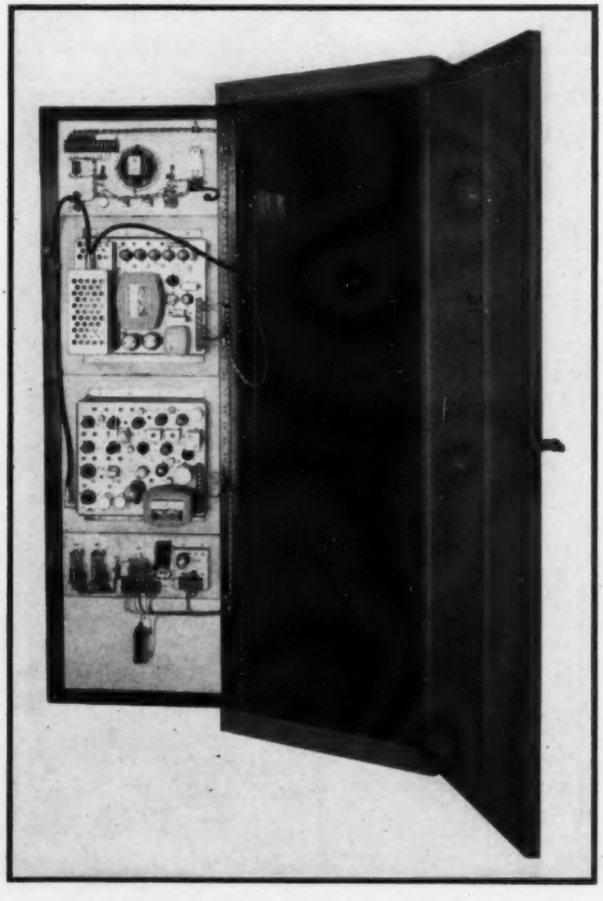
Now let us see what kind of equipment it takes to provide reliable communication under railroad operating conditions and the stages through which this equipment has passed in its development.

At this time, it is desirable to define radio communication for the purpose of this paper. There are two basic systems presently being tried out in railroad communication. First is the so-called inductive or carrier current system wherein low frequencies usually of the order of 50 to 250 kilocycles are used, with the energy transmitted by means of wire lines adjacent to the railroad right of way. The second system is the so-called space radio system, using comparatively high frequencies in the order of 160 megacycles and even higher. In this system, the energy is transmitted through the ether, and no conductor is necessary connecting the transmitting and receiving points. Since the great majority of our work has been with space radio because of its greater flexibility, this paper will be confined to the results which can be obtained by the use of space radio communication.

The history of experiments in railroad radio communication in so far as our company is concerned began in 1924. At that time, a semi-carrier current scheme was tried using frequencies of 50 to 60 kilocycles and 500 to 600 kilocycles. This experimental work was finally abandoned because we were unable to overcome the high noise level found at these frequencies.

Another attempt was made early in 1925 using a continuous wave beat note telegraph set-up to provide signal communication between the front and the rear of the train. This system was operated on frequencies of about 4 megacycles which were considered quite high at that time. It also was abandoned since the instability of the carrier frequency due to the motion of the train was excessive. Other tests were made with various railroads during the same year using frequencies of 2 to 3 megacycles with little better success. Later in 1925, tests were made in cooperation with the Norfolk and Western Railroad at Bluefield, West Virginia using an amplitude modulated radio telephone system at carrier frequencies of 2 to 3 megacycles and with a transmitter power of about 50 watts. Its lack of success can be judged by the fact that the Norfolk and Western Railroad officials decided that voice transmission would be eliminated and a tone signal only would be used to transmit the conventional whistle signals. Similar equipment was also installed on the Westinghouse interworks railroad at East Pittsburgh, Pennsylvania. This last test was considered to be fairly successful. However, the equipment was not considered reliable enough to be depended upon as an operating means over any period of time.

Figure 4 — The transmitter and receiver chassis are interchangeable with those used on the mobile equipment. Construction allows ready servicing.



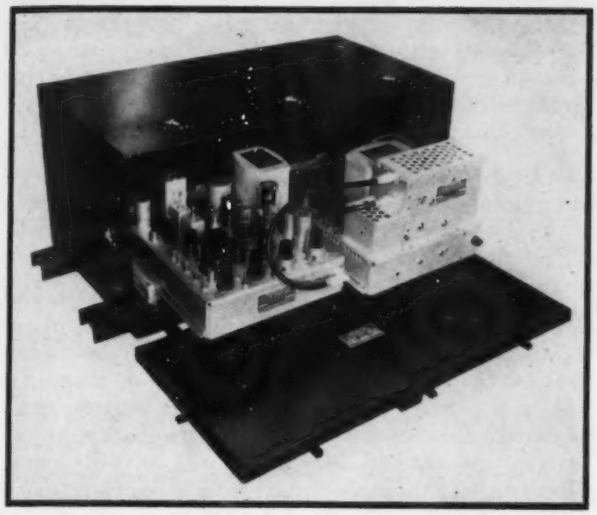


Figure 5 — The transmitter and receiving chassis are here mounted in a mobile case. Chassis slides in and out of case.

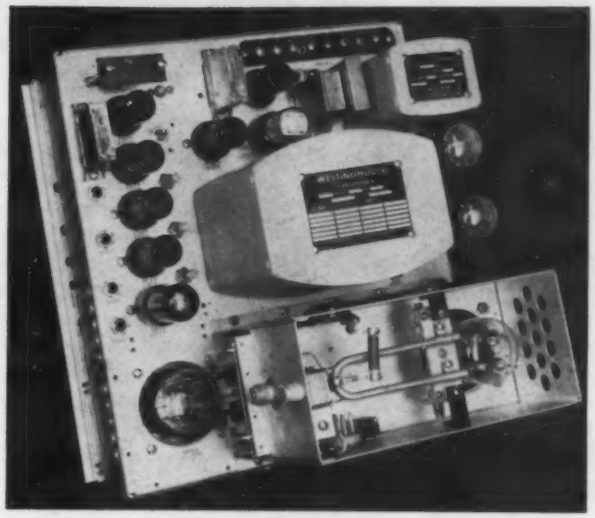


Figure 7 — In this view, the covers are removed from the two R. F. output tubes of the transmitter.

Other experimental installations were made from 1926 to 1934 on various railroads both for main line use between the front and rear of freight trains and for yard service. Varying degrees of success had been achieved to the point where radio communication equipment was used for about a year in the Sharonville hump yards of the Big Four Railroads at Cincinnati, Ohio. In this yard, a two way communication system between the switching locomotives and the yardmaster's office gave fairly reliable two-way communication between the control point and the locomotives anywhere in the yard and at distances up to about five miles. This system operated under all sorts of weather conditions, and began to demonstrate the reliability which can be built into this type of equipment.

By 1934, tubes and circuits suitable for use at higher frequencies had been developed. Since these frequencies opened up new possibilities in radio communication, arrangements were made between Westinghouse and the New York, New Haven and Hartford Railroad for rather extensive experimental work on front to rear communication. These tests were made over a period of 18 months, during which time the equipment traveled 36,000 miles and was operated for approximately 1,500 hours. During these tests, transmitters having power outputs between 1.5 and 15 watts were used on frequencies of 35 and 62 megacycles. These were used in conjunction with both super-regenerative and superhetrodyne types of receivers. Various types and locations of atennas were tried both on the caboose and locomotive. The various causes of interference were checked. The train on which the equipment was installed made a number of stops between New Haven and Springfield to pick up and set off cars. Through the use

Figure 6 — Layout of unit is such that servicing and adjustments can be easily made.

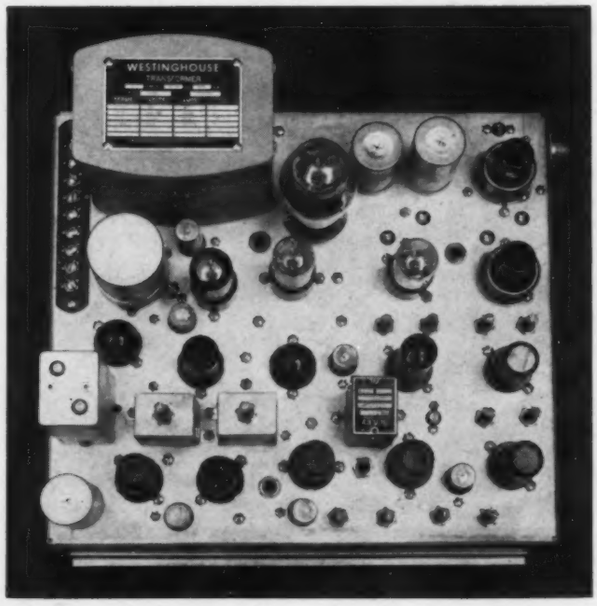
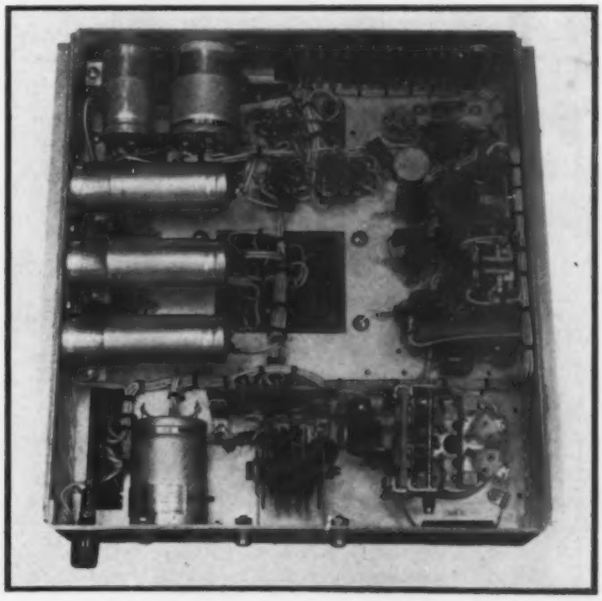


Figure 8 — Underside of the transmitter chassis.



of radio communication between conductor and engineer, there resulted an economy in switching time of between 20 and 25 per cent under the normal switching time of the train. On one occasion, a box car located several car lengths ahead of the caboose caught fire from a hot journal. The conductor immediately notified the engineer, and, using radio communication, had the engineer stop the train where a wayside telephone was along side the caboose. The conductor then notified a control tower at Meriden of the trouble and arranged to have them call the Meriden Fire Department to meet the train at a specified grade crossing. Again using radio communication, the conductor instructed the engineer to proceed to this crossing as rapidly as possible and spotted the burning car quickly and accurately, so that the waiting fire apparatus was able to extinguish the fire in record time. Thus a dangerous situation was averted due to the time saved by the use of radio communication. This example does not have any direct bearing on yard operating but it does show the flexibility of the communication system.

At the conclusion of these tests, the results were considered quite successful. The main difficulty encountered was noise due to various conditions such as microphonic joints between metal parts of the train and between axles, journals, wheels and track. This was considerably less when using the higher frequency of 62 megacycles than when using 35 megacycles.

Early in 1944, it was decided that in the light of present day developments, the answers to most of the previous difficulties could be found. After reviewing previous experience as well as more recent experience with wartime emergency equipment, it was decided that frequency modulation would eliminate the noise difficulties which had previously been encountered. The 30 to 40 megacycle band of frequencies was chosen in the light of our previous experiments in the mountainous terrain of New England and because experimental permits were then available at those frequencies. A new set of tests were arranged with the New York, New Haven and Hartford Railroad, this time to cover all varieties of railroad radio communication; front to rear of freight trains, train to wayside station, train to train and yard service.

A completely new set of equipment was designed based on a complete review of our previous experience in this field and after a considerable amount of consultation with railroad men.

A 30 watt frequency modulated transmitter and companion super-heterodyne receiver were designed together with a power supply unit and rotary converter to utilize the 32 volt primary power supply on the trains. The transmitter, receiver and power supply were mounted on one cradle which was in turn shock mounted against vibration and shock. The shock conditions were known to be the worst problem since the vibration is only about the same as in aircraft service. The entire assembly was mounted in a heavy sheet steel cabinet which was made water proof and dust proof to protect against the coal dust and water encountered on a locomotive tender. The components of the equipment were themselves designed to withstand high humidity conditions at high ambient temperature, consistent with experience in the design of military apparatus for tropical climates.

A control box and loudspeaker were mounted in the same cabinet. The controls consisted of only an off-on switch, squelch level and speaker level control. The microphone was a standard push-to-talk hand set.

In accordance with recommendations of the Association of American Railroads, this equipment was designed to operate from standard 117 volts, 60 cycle, single phase alternating current in order that the fixed and mobile transmitter and receiver units could be entirely interchangeable. The power requirements were approximately 125 watts standby and 275 watts full operation at 80 per cent factor at 117 volts a-c.

The transmitter employed seven tubes, including the

Figure 9 — The antenna unit is simple in construction and easily mounted.

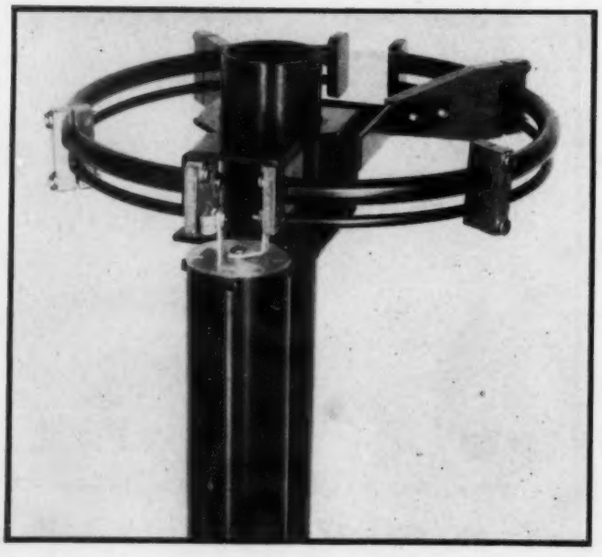


Figure 10 — Operation of the equipment requires the use of only a few dials.

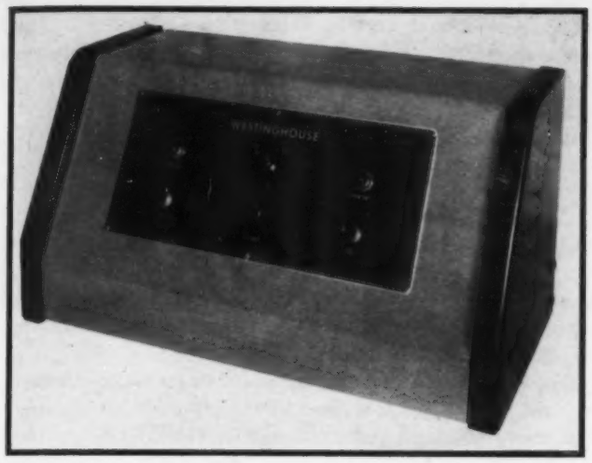


Figure 11 — The fixed station remote control console is the same as the mobile unit, except for an off-on switch.

rectifier, and was crystal controlled. The receiver used a total of fourteen tubes including a rectifier. It was a crystal controlled double super-heterodyne, using a single crystal oscillator for both I. F. channels to obtain the required gain with the fewest number of tubes and the best stability.

This equipment was mounted on the tender of a steam locomotive, on a standard caboose and in a control tower. After a trial period of seven months, a demonstration was run for the railroad with the following results. Uninterrupted noise-free communication was obtained from the front to the rear of freight trains of up to 130 cars in length. Results were in rugged terrain where the tracks wound through cuts and around hills and covered both electrified and non-electrified territory. Solid communication was maintained between the train and the fixed control station up to a distance varying from 10 to 12 miles, depending on the particular route of the train, as well as anywhere in a large classification yard or within the round house which was located about five miles from the tower. It should be noted that the control tower in this case was located in the city of New Haven, where the noise level due to industrial plants and sub-stations is relatively high. All of the ranges given above were taken as being the point where the signal to noise ratio was measured as being 20 decibels which is the equivalent of that obtained on a high quality long distance telephone line.

It should be pointed out that during the seven months trial period, no adjustments were made in the alignment of either the transmitters or the receivers with the exception of the antenna coupling when various types of antennas were tried. Three tubes in all failed, in one case due to a defective tube, and in the other cases due to overload of the transmitter rectifier in this experimental equipment. No failures occurred because of either vibration or shock given the equipment in normal freight and switching service. This equipment was exposed to the heat of summer and the cold of winter during this period. The final results obtained were achieved with the same equipment originally installed after this length of service. This will give you some idea of the realibility of modern railroad radio equipment.

In the summer of 1945, the Federal Radio Commission allocated the band of frequencies of 158 to 162 megacycles for railroad use. Because of this change, and as a result of the operating experience which had been obtained during the above mentioned tests, new equipment has been designed which operates on the above named frequencies.

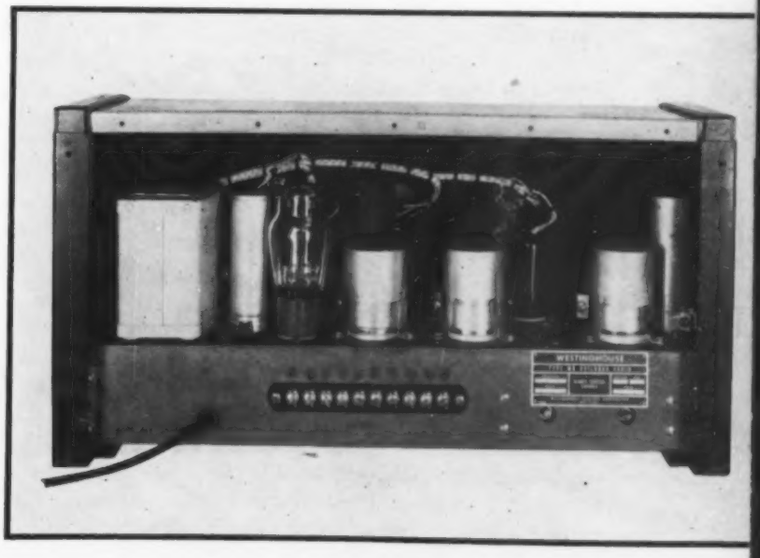
The transmitter now has 12 tubes and the power supply for it is located on the same chassis as the transmitter proper. An automatic microphone input level control has been added which will automatically take care of the difference in sound level of a shouting Irish brakeman or a whispering mike-shy conductor.

The receiver now has 16 tubes and its power supply is also an integral part of the receiver chassis. A new squelch amplifier has been added, so that the receiver will remain inoperative in the presence of any type of noise and will open only when a carrier is received.

A new simplified control box has been designed with only a limited gain control, lights to indicate transmitting or receiving condition, a test button and a call button. The loudspeaker has been separated from the control box so that it may be located convenient to the operator.

Since practical operation of radio communication for railroad service has been proved, the problem is now one of providing an integrated system which meets the requirements of each individual railroad. Auxiliary apparatus has therefore been designed to provide for remote operation of the equipment and suitable cabinets can be provided so that the system may be expanded to whatever degree found necessary with the least possible difficulty. Additional units will be designed as the need arises to provide such things as voice operated

Figure 12 — Rear view of fixed station remote control console.



control of the equipment and selective calling circuits.

The illustrations published with this paper show the equipment in its present form.

The equipment shown in Figure 1 is that necessary on either a locomotive or caboose for two-way operation. The antenna is mounted to a piece of one and one-half inch pipe which can be conveniently welded to the structure of the switch engine or tender. For steam locomotive operation, a differential noise cancelling microphone can be provided in the hand set which will eliminate the high background noise prevalent in such operations. Some people prefer a hand microphone for use in diesel switching engines where the noise level is low and this can be directly substituted for the telephone hand set. The loudspeaker only is then used for reception.

Figure 2 shows the equipment as set up for fixed station use. The antenna in this case would of course be mounted on a suitable tower or roof top. Various types of microphones and loudspeakers are available depending on the particular location in which the installation is to be made. These can be interchanged without changes in the equipment.

Figure 3 shows the fixed station equipment cabinet with the door open. The control unit located at the top of the cabinet provides complete control of the equipment for alignment and servicing operations. The second panel is the transmitter, the third panel the receiver, the fourth panel line coupling unit, and the fifth panel the main circuit breaker and any other required power control equipment.

Figure 4 illustrates the ease of servicing built into this equipment. Note that the entire rack holding the apparatus swings outward from the cabinet allowing complete access to the chassis units. The transmitter and receiver chassis, which are completely interchangeable with those used on the mobile equipment can be easily removed from the rear of their supporting panels.

In Figure 5 is shown the transmitter and receiver chassis as they are mounted inside the mobile equipment case. They are mounted on a rugged shock mounted cradle and are protected by the watertight heavy steel outside case. Note the ease with which these chassis units can be slid out of the case for servicing or adjustment.

A picture of the top of the receiver is shown in Figure 6. All alignment adjustments can be made from the top of the chassis, thus protecting personnel from accidental contact with high voltages.

Figure 7 shows the top of the transmitter chassis with the covers removed from the two R. F. output tubes. Figure 8 shows the underside of the transmitter chassis.

The antenna and its coupling tube to the coaxial cable leading to the transmitter is seen in Figure 9. These antennas are rugged, are simple to mount and are also interchangeable between mobile and fixed stations, and for any frequency used by the railroad equipment.

Figure 10 illustrates the simplicity of the equipment. The limited range volume control allows adjustment of the speaker output to suit changing conditions, and is adjusted so that the loudspeaker can not be shut off and calls therefore missed. A test button is provided to aurally show operation of the equipment and the call button provides a tone to attract the attention of the operator called. Pilot lights are provided to indicate that, when the green light is on the equipment is ready to receive calls, when the red light is on it is ready to transmit and when both lights are out, it is turned off.

The remote control console for fixed station operation of the equipment is illustrated in Figure 11. This console has the same controls located on it as does the mobile control box shown in the previous illustration. Additionally, since an amplifier is housed in this unit, an off-on-switch is provided to shut off the control unit only when not in use. A similar console is provided for local control of the fixed station equipment when desired.

Figure 12 shows a rear view of the remote control console showing the type of construction used. The rear cover has been removed in this view.

While communication between switching locomotives and the control tower has been specifically discussed, this same communication system can be applied with equal advantage to other types of moving vehicles. For example, it could be installed on a crane, which could then coordinate its operations with that of a locomotive on the track below or the crane could be summoned by a dispatcher at a control point.

It is usually possible to talk to locomotives which are fairly well within various industrial sheds without additional auxiliary apparatus. If such operation is required, it can be insured by installing an auxiliary transmitter and receiver within the building where such communication is desired. This transmitter and receiver can then be remotely controlled from the same point as the main station.

This discussion should convince one that radio communication as it exists today is a reliable communication means for everyday use. It is especially valuable under emergency conditions where saving of time is paramount. Particularly as applied to the industrial switch yard problem, it can assist industry in getting the most use out of existing yard equipment and can cut down the number of additional locomotives required to handle the coming heavy volume of production.

DISCUSSION

PRESENTED BY

HARRY V. CAMPBELL, General Electrical Foreman, Union Railroad Company, East Pittsburgh, Pennsylvania

G. H. PHELPS, Westinghouse Electric Corporation, Baltimore, Maryland

G. E. STOLTZ, Manager Metal Working Section, Westinghouse Electric Corporation, East Pittsburgh, Pennsylvania

Harry V. Campbell: I would like to ask a question on the high frequency of 158 megacycles. How would you transmit through a mountain or through tunnels? On lower frequencies, it was said to be all right, but how about the high frequencies?

G. H. Phelps: That is a very good question, but like a lot of others, the answer is indefinite. Actually,

the higher frequencies bounce a lot better than the lower ones do, and in actual practice we find that in such areas as in steel sheds or in urban territory, in cities, the higher frequencies are very much superior to the lower ones. On the other hand, the lower frequencies bend over the mountain tops somewhat better than the higher ones do. So in that particular case, the choice is difficult.

Our experience has been that the higher frequencies require less spacious equipment, the antenna is much smaller, and they are actually more usable than the lower frequencies, particularly in yard conditions.

I mentioned the fact that whether a steel shed is located one way or another, pointing at or across the main transmitting station, for instance, makes considerable difference. If the shed is lengthwise with respect to the main transmitter, you can usually talk practically through the shed. On the other hand, if the shed is across the line from the main transmitter it offers difficulties if it is a steel shed.

G. E. Stoltz: It is quite obvious that this equipment must be made shock-proof to withstand the rough service in steel yard switching. Mr. Phelps has not only had experience in the field tests he has made, but we have also drawn from the experience we have had in building radio equipment for battleship installations.

I had occasion to see a photograph of some of the New Haven apparatus. The receiver and transmitter were located on the coal tender, and it seemed to be at a place where it could receive a great deal of rough treatment. I was told that coal had to be removed from the enclosing cabinets before the photograph was taken. I would like to have Mr. Phelps give some of the experiences he has had with the way this apparatus has been treated.

Another question which comes to my mind, is how clear conversations can be heard when a locomotive goes deep into steel buildings which are so commonly used in steel mills.

I understood several months ago that frequencies had not been assigned for this type of application, and I am under the impression that one frequency might be assigned to Pittsburgh and another to Chicago and still another to Birmingham. I would like to have Mr. Phelps advise if frequencies have been assigned, and if they have been, will they be permanent?

G. H. Phelps: I think the best illustration of what the equipment will stand was one trip we made in the caboose of a normally scheduled freight train on the New Haven. We went to Boston, and on the way up, the stoker in the locomotive broke down so that they had a good deal of trouble with it, with the result that the train was not handled in a normal manner. While going down a grade, something happened and I haven't figured out yet what it was, but it took the pot-bellied stove off the floor of the caboose.

On that train was the same equipment that about three months later, without anything being done in the way of realignment, showed the results we reported. The equipment in the locomotive was in constant operation, whether we were using it or not. You will remember that last year locomotives were rather scarce articles, and the New Haven Railroad wouldn't tie up a big Santa Fe engine for our benefit. So when we weren't using the equipment, the locomotive was out on the road doing work, and as stated, the equipment operated after all this general operation had been done. In other words, we didn't have a laboratory aligned set on the train when we found out how far it would talk or how far it would not. The equipment had withstood about seven months of about the worst kind of a beating that the New Haven Railroad could give it.

On this business of what the frequencies do around the steel yards, I would in some ways prefer steel sheds to wooden sheds, because with the steel sheds you know that the frequencies will bounce. I notice that a great majority of the steel yards seem to be laid out more or less in line, and there is some alignment in the buildings, so by selecting the antenna, and incidentally not putting it too high, it is usually possible to talk the full length of most of the steel buildings. If you place your antenna so it is closer to that building through which the locomotives run, you will have very little trouble with it.

Another thing that helps, is that some of these plants have transite roofs. Now transite roofs do not bother this particular frequency which goes right through such roofs.

The problem is an individual one with each railroad, and each particular yard has to be looked at and analyzed before you can say with assurance, what will happen.

There has been a complete listing of all of the Class I railroads in the country who showed any desire to ever use radio communication and frequencies were assigned to these railroads. That leaves the industrial yards and the switching operations of Class I railroads a secondary consideration, but since the reason for getting the frequencies from FCC was the main line operations, that was the result. Actually in the Pittsburgh area, there are comparatively few main line frequencies assigned between 158 and 162 megacycles, which leaves quite a few of the other 60 total channels available for use by industrial yards.

It is quite possible that directional antennas may have to be used in order to allow the same frequency to be repeated in a given area, but that question hasn't come up because there are not that many pieces of railroad radio equipment now in use.

On the other hand, yard operation is permitted along with television operation on a non-interference basis. Who is going to get what television channel in different parts of the country has not yet been decided, so who is going to have what frequencies for railroad yard use in different parts of the country is equally undecided. Those frequencies will stretch from 44 megacycles in blocks through to 96 megacycles, and then jump up to somewhere around 200 megacycles, with the normal railroad band in the middle. However, that situation is completely undecided until the television band is set.

The Federal Communications Commission has said that we can operate on a non-interference basis, and I have yet to find anyone who can tell me what that means. Whether radio will interfere with television, and if so, in terms of what actual numbers, is unanswered. That is rather unsettled, and is why we used the 158 to 162 megacycles band.

(*Please turn to page 78*)

Recent Developments in TUBE REDUCING

. . . over the past years, major improvements in tube-reducing machines have greatly increased their versatility in tube-forming applications . . .

By George B. Coe

CONSULTING ENGINEER

TUBE REDUCING CORPORATION

WILMINGTON, NEW JERSEY

▲ THERE are several developments in the application of the Rockrite process and certain changes in the construction of the tube-reducing machine which are of more than ordinary importance. It therefore seems appropriate, now that we are no longer preoccupied with the urgent problems of war work, to review some recent changes that have been made in the tube-reducing machine and to examine the newer products which can now be made by the process.

Those who are not familiar with this method of tube sizing may find the following brief definition of the tube-reducing machine helpful. It consists generally of a motor drive connected to a reciprocating frame or saddle which contains a bottom and top roll, into which are inserted the required hardened dies. The bottom roll has rack gears and inter-locking gears mounted on either end; these rack gears mesh into stationary racks securely held on either side of the machine. The interlocking gears mesh with gears mounted on either end of the top roll, and by this means the rotary motion is transferred to these rolls when the saddle is reciprocated. A mandrel rod is securely anchored at the rear end of the machine and is adjustable; to this a tapered, hardened mandrel is fastened.

A feeding and turning mechanism, located at the rear of the machine, driven by the main drive, and synchronized with the motion of the saddle, feeds the starting tube by pre-determined increments, and turns the tube the required amount. When the saddle is in the back position, the tube is fed forward and the tapered groove in the dies reduces the tube while they are being driven forward. At the forward position of the saddle, the tube is turned, and the groove in the dies rolls back up the tapered section.

It is very important that this saddle be of heavy construction so that it can absorb shock and thus promote smooth action of the machine. It is also important that the saddle be supported properly. In the latest design of the machine, the saddle is overhung and supported on wheels which contact hardened flat tracks. These tracks are now so located as to eliminate contamination by abrasive materials, and are easily accessible for lubrication and maintenance. All chances of slippage or skidding are controlled, eliminating wear and brinnelling of both tracks and wheels. Furthermore, the distance between the contact point of the wheels on the tracks and the center line of the tube has been reduced as much as possible. This, coupled with the location of the wheels evenly on both sides of the center line of the saddle, and the long wheel base, assures smooth action and eliminates the tendency of the saddle to lift on reversals of the stroke and at the time of contact with the tube.

It is also necessary that the heavy cast bases be sufficiently heavy to absorb shock and to re-act against vibrations set up by the reciprocating action.

The successful application of this process depends greatly upon the proper design of the dies and mandrels. This in turn is determined by the type of reduction to be made and by the material to be reduced. The requirements of a material of high yield point and rapid cold work hardening qualities differ greatly from those of low yield point that work harden slowly. The groove in the dies should be designed to accomplish the greatest reduction while the metal is in the soft stage, but it should never be carried to a point where work hardening becomes so severe as to defeat the final finishing of the tube, in the forward section of the die, nor should it be so great as to cause extreme back pressures and shock to the machine and tools. The taper preceding the straight section of the groove should be as shallow as possible to obtain the required reduction, so that the area to be reduced at this point is at a minimum before the tube enters the finished die section. It is at this point that the metal has received a full amount of work hardening, and the attempt to do much

Presented before AISE Pittsburgh District Section Meeting, February 18, 1946.

additional work will impose severe loads upon and shorten the life of the tools and neck bearings.

The foregoing provides a clue to the now well established fact that there is no one percentage of reduction in the size of a tube that can be adopted as standard or used as a measure of machine performance. Reasons for this fact are also found in analyzing the varying requirements of four typical classes of work:

1. The reduction of heavy-wall starting tubes.
2. The reduction of thin-wall tubes.
3. The production of tubing to be shipped direct from the tube-reducing machine.
4. The production of tubing for stock and further finishing operations.

While it may be convenient to refer to the reduction in terms of percentage; as 25 per cent, 50 per cent, or 75 per cent; or as ratios such as 3 to 1, 4 to 1, or 5 to 1; such terms can be misleading. Actually it is the reduction of cross-sectional area of a heavy-wall starting tube that is a measure of the work done on the metal and that constitutes a reliable guide to how much can be accomplished in the reduction of a given metal.

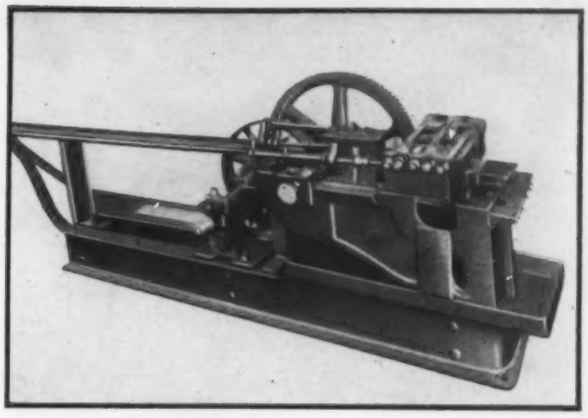
For example, consider a starting tube 3½ inches outside diameter and ⅝ inch wall. It has a cross sectional area of 5.65 square inches. A 75 per cent reduction of this area would mean a reduction of 4.24 square inches. This reduction is entirely feasible with mild steel or certain low alloys. In fact mild carbon steel could be reduced 4.85 square inches and a mild alloy 4.6 square inches. But the reduction of a hard alloy should not exceed 3.8 square inches. A greater reduction would result in undue wear of the neck bearings, dies and mandrels.

Again consider the 6½ inch machine with a starting tube 5 inches outside diameter and 1 inch wall. This tube has an area of 12.56 square inches. A reduction of 75 per cent would mean 9.42 square inches reduced, which is beyond all reasonable expectations. As a matter of fact this machine is capable of reductions of 5 to 5.35 square inches of hard alloy steel, 6 to 6.7 square inches of mild alloy steel, and 7 to 8.9 square inches of mild carbon steel.

The number of square inches to be reduced is a reliable guide for starting tubes from the largest down to 3 inches outside diameter with ½ inch wall. For those with thinner walls a trustworthy guide is the percentage of total area to be reduced. This is also true of the second class, mentioned, thin wall tubing.

Tubing that is to be shipped direct from the machine differs from that sent to stock and which is to receive further finishing. In the former case accuracy and surface finish of the product are more important than in the latter. When further finishing is to be done, the rate at which the tubing is fed through the machine can be increased and simple mandrels can be used. Production is correspondingly greater with some sacrifice of accuracy and surface finish, qualities which, in this case, are of less importance than in tubes produced for shipment without further work.

Shortly before the war the possibilities of expanding the applications of the process were explored and some development work was carried out along these lines. Certain experiments were necessarily deferred, but others were completed in a much shorter time than would normally be the case, because they had a rather



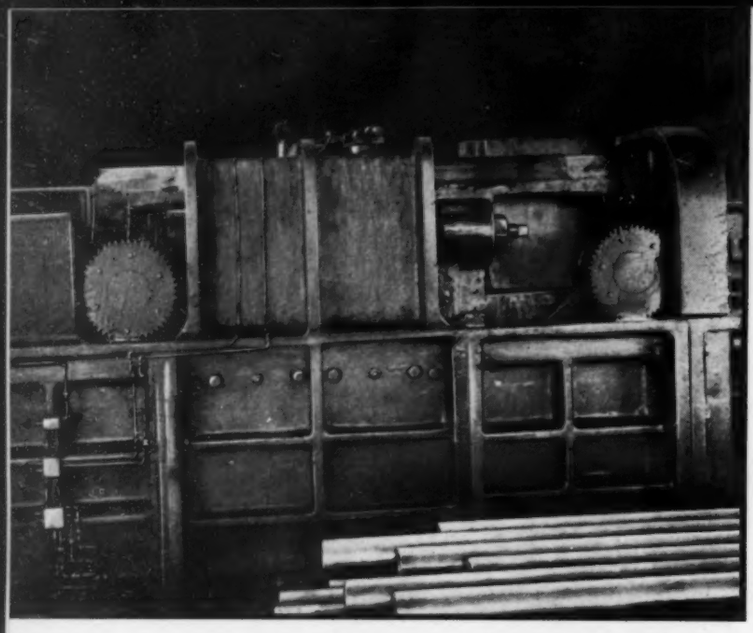
The 1929 design for a tube-reducing machine is illustrated here.

important bearing on special war problems. Thus we are now in the position of having demonstrated the feasibility of accomplishing quite a few results which three or four years ago were subjects of conjecture and not optimistic ones at that.

Some of the newer products that can be produced today are:

1. Ball-bearing tubing.
2. Oil-well tubing.
   a. Pump liners.
   b. Pump pistons.
   c. Sucker rods.
   d. Pump shafts.
3. Shaped-bore tubing.
   a. Socket-wrench material.
   b. Internal gearing.
   c. Splined, sliding sleeves.
   d. Shaped-bore couplings.
4. Finished tubing of all materials from 3 in. outside diameter to 6.000 in. outside diameter, both heavy wall and thin wall.
5. Controlled-bore tubing for:
   a. Hydro and pneumatic cylinder liners.
   b. Pump liners.
   c. Wrist pins.

Shown here is a battery of tube-reducing mills.



Modern tube-reducing machine, built in 1943.

6. Stainless-steel tubing.
7. Tapered tubes, with or without upset or flanged ends, single tapers or blended multiple tapers, and step tubing.
8. Bi-metal tubing, both lined and clad.
9. Long-length tubing, to eliminate joints in coils, and for rubber-hose mandrels and similar applications.
10. Processing of electric-welded tubing.
11. Extremely-thin-wall tubing, from 0.012 to 0.008 in. thick, in all types of material.

It has been found that in many cases desired physical specifications can be met in tubes taken directly from the machine without further heat treating. In some instances, a low-temperature controlled-atmosphere relief-anneal can be used to meet required physical specifications without materially affecting the high tensiles and high yield points of the product. In many instances the yield and tensile have been increased 80 per cent or even double those of the original starting tube.

DISCUSSION

PRESENTED BY

J. E. McLAUGHLIN, Superintendent Tube Division, Aluminum Company of America, New Kensington, Pennsylvania.

GEORGE B. COE, Consulting Engineer, Tube Reducing Corporation, Wallington, New Jersey.

GLENN W. GARWIG, Sales Engineer, The Aetna-Standard Engineering Company, Youngstown, Ohio.

J. E. McLaughlin: We have been operating tube reducing machines for 11 years, although 3½ in. is the largest size we have. I would like to ask Mr. Coe how he produces that taper. Do you produce it by beginning with the large size, taking it off before it is completely reduced, and then starting it in another set of tools to make the second taper?

George B. Coe: The length of taper is controlled by the length of the groove in the die, so that the first taper, near the butt end of the tube, naturally is the larger. Then in this instance, on account of the extreme wall reduction in 4350 steel, there is a relief anneal at low temperature and reduced again in the second operation. The tube is positioned so that the groove in the die overlaps, at the mouth, or the large end of the groove. The groove is sufficiently large so that you get a perfect blend from the first taper, and this method can be carried on further.

We are going to make 25 foot propeller cores, which will take four operations. The third operation on the tube incorporates a combination of the final taper and the pointing of the tube. However, remember you have a tapered section for every foot of straight tube you make, so it is rather a natural development.

J. E. McLaughlin: In producing those tapers if you don't have to worry about the inside diameter you wouldn't have to use a mandrel, is that not correct?

George B. Coe: Taking a wall, starting at 0.340 in. and ending at 0.040 in. thick at the extreme end, you must have a mandrel. You could taper without a mandrel, if you didn't go to the extreme, or where you didn't break up the inside diameter.

J. E. McLaughlin: I haven't seen your 6½ in. machine. Is it true that it can accommodate only one groove in the tools?

George B. Coe: Yes.

J. E. McLaughlin: Has the idea ever been carried forward of having more than one groove?

George B. Coe: No.

Glenn W. Garwig: Is the 6½ in. machine used on steel tubing or on non-ferrous tubing?

George B. Coe: It is used on steel tubing such as 4350 steel. Of course, that was a war development for making propeller cores, but we have made the design and are carrying it right through into a machine which will make the straight tubing, starting with the largest tube, 6½ by ⅝ in., on hard alloys.

Phelps DISCUSSION

(Continued from page 75)

G. E. Stoltz: Let us assume that an installation of radio communication equipment is made in Pittsburgh, and a frequency of 158 megacycles is selected. Later, if a television station were installed in Pittsburgh, am I to assume that the purchaser might have to change his frequency.

G. H. Phelps: That is correct.

G. E. Stoltz: Is that an expensive change?

G. H. Phelps: That can be a big item in any band except the 158 to 162. In other words, these television bands go in blocks, not individual frequencies, and you can't change a transmitter designed for 158 to, say, 90 megacycles without a major operation.

To begin with, the proper choice lies in 158 to 162 megacycles, which has been assigned exclusively to railroads. Only a few of those frequencies have been used in the Pittsburgh area or are assigned in the Pittsburgh area. At the present time it would be fairly simple to pick out a frequency which would be used in the Pittsburgh area, and there would be no case of being switched from it later.

Open Hearth Operations
AT WICKWIRE-SPENCER STEEL

. . . . steel for use in wire requires better than average control of uniformity and quality . . . . in November 1945, Wickwire Spencer converted their furnaces from producer gas to oil with several resultant advantages . . . .

By John B. Fleming

SUPERINTENDENT OF OPEN HEARTHS

WICKWIRE-SPENCER STEEL DIVISION

COLORADO FUEL AND IRON CORPORATION

BUFFALO, NEW YORK

▲ THE Wickwire Spencer Steel division of the Colorado Fuel and Iron Corporation is engaged in the production of steel solely for use in the manufacture of wire and wire products. Consequently, good furnace operation is an important factor in producing steel of the proper analysis without encountering undue delays and difficulties.

Our furnaces were fired with producer gas from the time they were built in 1916 until November 1945 when we converted the furnaces to fuel oil. Our objections to the producer gas were many, and I will not attempt to mention all of them. First, it is a fuel that makes dirt, much of which was deposited in the checkers and flues thus retarding the operation of the furnace. It required a down time of the furnace of from two and one-half to four hours once a week to clear the gas mains of the accumulation of flue dust that partially blocked them during that period. In addition, there is the gas house to operate and maintain which is an item not to be overlooked, as well as the variations in the quality of the coal received from time to time. Finally, the labor with which we had to operate these units in the past few years had their effect on the quality of the gas being delivered to the furnaces.

On the producer fired furnaces last year, we had an average roof life of 220 heats per roof. These roofs were ribbed, the depth at the rib being 20 in., and the roof itself was 15 in. thick except for two feet adjacent to the back skew which was 18 in. thick. The ribs have been eliminated in the present roofs and a flat roof is now being used.

The furnaces are equipped with stack dampers controlled by a motor operator receiving an electrical impulse from the furnace pressure control. The furnace pressure is recorded on a furnace pressure recorder with connections to the pressure control impulse lines. Four point checker temperature recorders are installed with the thermocouples in the outgoing flues of each checker chamber. These temperature recorders are equipped with alarm signals which may be set to signal an alarm at any point on the scale as a reversal signal.

Constant speed blowers with louvres on the discharge side of the blowers to regulate the flow of air to the furnace is controlled by an indicating air flow controller of the air operated type.

The indicating oil flow controller is of the air operated type using an air motor to control the flow of oil through the medium of an adjustable port valve. There is an electrical pneumatic relay in this system with limit switches on the outgoing flue valves to prevent the readmittance of oil to the furnace until all valves are properly positioned. The furnaces are equipped with roof temperature recorders with radiation pyrometers sighted through the back wall at the center of the furnace roof.

We are using water cooled frames of the archless type and water cooled, paneled type doors. The doors are lined with clay brick. The door life on the producer fired furnaces gave an average life of 40 heats per lining. It might be interesting to note that the door life on the oil fired furnaces to date is 78.2 heats per lining, and we line our doors with new brick rather than reclaimed brick. At the present time we have some doors in use with plastic linings but they have not been in use long enough to date to give any data on them.

Basic end walls and front walls with sheet stiffners are being used. Records to date tend to reveal that we may expect enough increased life to more than justify the additional cost. Incidentally, we feel longer life

Presented before AISE Buffalo District Section Meeting, February 12, 1946.

material to reduce repairs is more important in the small plant, because it permits the retaining of a much smaller repair crew which cannot be used to any degree of success between rebuilds.

Change in the slag pocket design on the oil fired furnaces has increased the slag pocket volume considerably; this will mean considerable increase in tonnage on each campaign and reduce rebuilding costs. Checker life should also improve and will require much less cleaning during campaigns and rebuilds. Improvements in handling material, and the use of a tractor type dirt loading machine for the removal of brick from the slag pockets are also contributing to effect lower rebuilding costs. This is also made possible by the larger slag pocket.

We are using a dolomite machine which we feel saves us considerable time and keeps labor in a better state of mind. Raw dolomite only is used in this machine, and any burnt dolomite is put in the furnace by hand.

The back wall is made up with the machine over each heat. The back is also given a light make up using the machine after each heat. The ends of the furnace and the front banks are made up after each heat using burnt dolomite for the most part.

We allow thirty minutes from tap time to start of charge time before any lost time is charged against the furnace. It might be said here that we are now averaging thirty-seven and one-half minutes between heats which is considerably better than we were previously doing.

At the present time we are using a low or no-ore charge. This is due to several factors. Our quantity of hot iron is limited due to the fact that only one blast furnace supplies our demand. For the most part, steel scrap and pig iron make up the open hearth charge, and since ingot cost is governed to a great extent by the cost of raw materials, the proportion of scrap and pig iron is governed to some extent by the price of one against the other. This simply adds up to charging more scrap when the price of scrap is down, or charging more iron when the price of iron is down.

Soft ore is the most commonly used as charge ore in our open hearth practice because there has always been an abundance of it and because it may be used with little, if any, preparation, which is a matter of cost again. As experience has taught us, there are ores that are not suitable for open hearth use. Ore for open hearth use with a low ignition loss is desirable so as to insure minimum furnace reactions when the hot iron is put in the furnace and a low silica content is desirable for the protection of the furnace.

The use of ore charges results in less scrap to be charged, and therefore, shorter charging time and less cold scrap to melt down since the cold scrap is replaced with hot iron. In addition, the lower the scrap charge, the less trouble we have with residual alloys which are not wanted in the wire business.

It might be of interest here to say something of the vacuum conveyor unit we installed in the open hearth for the purpose of cleaning flues, since we have found this unit to be useful in other operations around the furnaces. The introduction of this unit in the open hearth has proven very advantageous from a time and money-saving angle. The operation of this unit in flue cleaning is quite simple. When used thus, the unit is erected on a structural steel platform just outside the open hearth cellar in a position where a car may be placed under it to collect the flue dirt as the machine empties itself. A four inch pipe line runs the full length of the open hearth cellar directly in front of the checker bulkheads with provisions made at each set of checkers for connecting the feeding hose to go down underneath the checkers. Provision is also made for a connection to go down in the main flue which goes to the stack. This arrangement is very satisfactory as these connection points are all permanent. An idea on how the unit operates, is as follows: The receiving tank which is conveniently located to handle all furnaces is put under vacuum. When this goes into operation, the dirt is sucked into the pipe line through a flexible hose, to the end of which is attached a receiving nozzle into which the flue dirt is fed. As many men as the job requires are used in this operation. Any excess dirt that may exhaust from the primary receiver is taken care of by a small receiver hooked onto the primary receiver. An idea of what this unit has meant to us in time and labor is illustrated by the following example. With the producer fired furnaces, we were always confronted with excessive flue dirt which would tend to block the draft at the base of the stack. To clear this accumulation at the base of the stack required from four to six hours, and employed at least six men due to the temperature and the distance the flue dirt had to be carried for removal to

View of interior of the furnace showing the burner and burner port.

the manhole. We now can accomplish this same job, with the use of the vacuum conveyor, in an hour and one-half using four men. The last job of this nature required one hour and twenty minutes and the use of four men. During this operation, the furnace was down one hour and fifty minutes as against four and one-half hours under the old method. This is a saving which is worth while.

Our ingots are all top cast in big end down molds of the rippled type. The molds measure 17½ × 18½ × 76½ in. high. About fifty per cent of our heats are hot-topped using the tile type hot-top, and a hot-top blanketing material. This practice gives us an ingot suitable for our product. All hot-topped heats are allowed to stand in the molds 45 minutes after being poured before being moved to the stripper for stripping. The hot-topped heats are all back poured. By back pouring we mean that we fill three molds up to the hot-top and then go back and fill up the hot-top on the first mold and immediately apply the hot-top blanketing. This practice is continued throughout the heat. We pour through a one and one-half inch nozzle using about 37 molds on the hot-top heats and about 45 molds on rimmed heats. Pouring yield runs about 98 per cent.

This practice of pouring gives us upward of 100 shut-offs per heat plus the dribbling to fill up the hot-top. The stopper rod assembly consists of a one and three-quarter inch rod using a graphite stopper head and clay sleeve brick nine and one-half inches long by six inches in diameter with a two inch bore. The stopper head is the pin type using a standard one inch by seven inch button head rivet for the pin. The rivets are sent to the forge shop where the slot is punched in them for the keys which fasten them to the stopper rod. Our experience has taught us to use the stopper pins and keys once only, in short, each heat has an entirely new stopper except for the one and three-quarter inch rod itself. We know that stopper pins may be used for more than one heat, but we also know that it takes only one heat, poorly poured, due to a bad stopper, to furnish the cost of a good many one inch by seven inch stock rivets. We have convinced ourselves that using the stopper pin but once is a definite insurance against bad pouring practice.

We have no mold yard and little or no room in the stripper building, other than what is needed for stripping. Therefore, after the heats are stripped at the stripper, the empty molds are returned to the open hearth pit where they are cleaned, sprayed, and the hot-tops placed on them for the next heat. There is a set of molds in service for each furnace in operation plus a set of buggies with stools at the stripper. As the heat is stripped, the empty molds are placed on the empty buggies to be returned to the open hearth pit. The ingot buggies carry a double line of molds with six molds to the buggy.

The slag overflow from the steel ladle is taken in a slag thimble; these are then taken to the skull cracker where they are dumped, and the slag is broken up for the reclaiming of any steel that might have gone into the slag thimble. A good share of the slag is screened for size and sent to the blast furnace where it is charged for reclamation of the manganese.

Our pit practice includes the cleaning of the ladle pit and monkey hole after each heat. We have made this standard practice, no matter how little cleaning there is after each heat, to avoid having them build up to a point that may cause trouble, even if we must take lost time on heats. Our pit work is, for the most part, done with a magnet and a three yard self-stripping bucket.

DISCUSSION

PRESENTED BY

H. H. NORTHRUP, Assistant Open Hearth Superintendent, Republic Steel Corporation, Buffalo, New York

J. B. FLEMING, Superintendent of Open Hearths, Wickwire-Spencer Steel Division, Colorado Fuel and Iron Corporation, Buffalo, New York

HORACE G. JOHNSON, Chief Observer, Wickwire-Spencer Steel Division, Colorado Fuel and Iron Corporation, Buffalo, New York

J. F. BLACK, Assistant Works Manager, Atlas Steels Limited, Welland, Canada

JACOB A. EKHARDT, Combustion Engineer, Wickwire-Spencer Steel Division, Colorado Fuel and Iron Corporation, Buffalo, New York

A. C. TEXTER, Electric Furnace Superintendent, Atlas Steels Limited, Welland, Canada

H. H. Northrup: All through the paper I could see that Mr. Fleming was aiming at one thing, and that was to sharpen up the open hearth furnace by cleaning the flues and by changing to an oil fuel thus getting the proper pressure control for proper draft. This sharpness of the furnace is, as I see it, the main factor in an open hearth superintendent's job. Once he gets a sharp furnace, he can command the best results. No man wants to work or handle a logy furnace.

I was interested in a few things, one was in changing the roof from a rib roof to a flat roof. I was wondering what the advantage was in that change. You say you get 220 heats.

At Republic Steel we have somewhat larger furnaces. We have four 240-ton furnaces, the balance are 120 tons, making an average of 224 heats per roof. The reversal system you use, as I understand, is all manual, and I wonder if an automatic reversal system could be used to advantage. Sometimes men are not right on the job or are doing something else when it is necessary to reverse the furnace, and keeping an even checker temperature does help. The roof temperature indicator we have found is one of the best means for improving fuel practice, and I think we have reduced our own fuel cost mainly through that installation. Our furnace trouble is more apt to be getting heats too hot too soon.

We make all kinds of steel, carbon and alloy, and I feel that correct pouring temperature is very important.

Another thing, have you done anything with pulling heats early? We don't allow the heats to stand in the pit. Heats are pulled out of the pit after 60 tons have been poured. We use a cast iron hot-top, and allow 35 minutes standing before stripping the hot-top, and we use no insulating covering for we found it is a dis-

advantage to keep them covered. It keeps the steel hot too long, and causes a safety hazard because of splashing when moved.

J. B. Fleming: We have tried some changes in practice such as switching out the first half of the heat as soon as it is poured when the whole heat is poured in one string of cars, the first ingot poured is in the molds considerably longer than the last one, and there is considerable difference between the ingots going in the pits. We have our difficulties in shifting, and so forth, but we do think we will be able to work out such problems.

H. H. Northrup: You probably get little smoke now?

J. B. Fleming: Very little in the present oil fired furnaces, and we find very little accumulations in the flues.

H. H. Northrup: Do you blow your checkers?

J. B. Fleming: We had to blow them often and blow them well.

H. H. Northrup: How big are the checker flue openings?

J. B. Fleming: About 5½ in. square. With oil we haven't had to blow checkers at least up to a hundred heats, and in looking at the checkers through portholes, there is nothing there to blow off.

H. H. Northrup: Do you adjust your oil burners?

J. B. Fleming: They are adjustable up or down and sideways. They are our own design.

H. H. Northrup: How about pouring temperatures?

Horace G. Johnson: Pouring temperatures are more or less up to the operator.

H. H. Northrup: We think temperatures control is so important that we are specifying our tapping and pouring temperature. Thus, we have increased our percentage of good pours of critical grades of steel.

J. B. Fleming: In our experience the temperature in the molds means a whole lot. I would even say the temperature of the molds has a great deal of bearing. As far as we are concerned, on semi-killed heats we would like to see a breaking signal.

We feel that there is no excuse for a bad stopper. In our practice, we are convinced that if the stopper is assembled right, and if it is on firm, it will pour all right, provided the heat is right.

J. F. Black: Have you any figures to indicate your furnace time?

J. B. Fleming: Before we had the instruments, we had some trouble with the oil, but if the oil figures coming from the receiving department are correct, we are paying quite a little less since we had the instruments installed.

J. F. Black: How does your fuel per ton now compare with producer gas operation?

Jacob A. Ekhardt: On cold iron products, we have had an average of about 35 gallons to the ton; on hot metal we have had a little better.

J. F. Black: What is the steel making capacity at the Wickwire Spencer shop?

J. B. Fleming: We have four furnaces, three in constant operation, so capacity is about 200,000 tons per year.

J. F. Black: Have you entered the alloy field in the manufacture of wire, or do you keep mostly in the low carbon range?

J. B. Fleming: Our carbon ranges around from a low of 4 to 90 points.

J. F. Black: Have you done any standardizing of the brick you use in your furnaces, and do you have anyone studying the brick you use in your open hearth?

J. B. Fleming: Until we converted to oil, our furnace was almost entirely of silica brick outside the front and back walls, but when we changed to oil, we put sheets on the front wall. To date, it is not fair to state the results, since the furnaces have not been in operation long enough. The oldest furnace we have in operation built for oil, hasn't a minute charged against it to date.

H. H. Northrup: What do you do with the brick layers if you have the furnaces running all year? It is our experience that when we don't use them on rebuilds, we must find work for them some place in the department.

J. B. Fleming: I am in the same position, and the open hearth must take its share of the expense.

A. C. Texter: What particular grade of steel was Mr. Northrup talking about.

H. H. Northrup: Any grade of steel and alloy steel.

A. C. Texter: What percentage of steel is in the hot-top?

H. H. Northrup: About 14 per cent.

A. C. Texter: Do you measure your temperature?

H. H. Northrup: We measure it, and aim to pour 10 to 15 point carbon steel around 2800 degrees.

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Automatic Acceleration for D-C MOTORS

. . . . outlining several methods of constant voltage automatic acceleration control . . . .

By E. J. Posselt

SUPERVISING ENGINEER

CUTLER-HAMMER, INC.

MILWAUKEE, WISCONSIN

▲ FOR years the most common method for accelerating a direct current motor has been to connect the motor to the line in series with a resistor and reduce the resistor value by increments until the motor is connected across the line. The same method is extensively used at the present time. On magnetic controllers, sections of the resistor are usually by-passed in steps by a number of accelerating contactors. Automatic control for the accelerating contactors, however, have been changed as new schemes and equipment has been developed. Some of this equipment with an explanation of how it is designed to operate will be described in this paper.

Standards have been adopted by NEMA which specify the number of accelerating contactors for different types of controllers. An average size crane controller, for a roller bearing crane, would be provided with three accelerating and one plugging contactor and a resistor classified as number 162. This resistor would allow approximately 50 per cent full load current for the starting inrush. This is equivalent to about 40 per cent torque for a crane type series motor. The resistor stepping and the closing of the accelerating contactors would be set to provide speed torque characteristics similar to those shown in Figure 1. If it is assumed that each accelerating contactor closes at about 100 per cent torque, the curves indicate that with a series wound crane type motor the accelerating torque peaks will be about 185 per cent. Plugging contactor P closes without delay when starting from rest but is set to close just before the motor reverses when it is plugged. Any change in the resistor values or point at which the accelerating contactors are closed will change the accelerating characteristics of the motor. The function of a controller with automatic acceleration control is to provide accelerating characteristics similar to those shown in Figure 1 and be consistent in performance after the proper adjustments have been made.

Many automatic accelerating methods have been employed. They may be divided into two general classes. One is known as current limit acceleration and the other as time limit acceleration.

Current limit acceleration, is a method in which the accelerating devices are operated by the motor current. Since the motor current taken from the line decreases as the motor accelerates, the accelerating devices may be used to control the accelerating contactors and cause them to close at preset motor currents. The principal forms of current limit acceleration are those using:

1. Counter-emf acceleration.
2. Series relay acceleration.
3. Series type contactors.
4. Lockout contactors.
5. Voltage drop acceleration.

Line current decreases as the motor accelerates because the motor counter voltage increases during acceleration and opposes the line voltage. Starters with counter-emf acceleration are controlled by the armature counter voltage for closing the accelerating contactors. A scheme for this type of acceleration is shown in Figure 2. The closing coils of the accelerating contactors are connected across the motor armature. The first accelerator 1A, is designed to close at approximately 50 per cent voltage. Accelerator 2A, is designed to close at about 80 per cent voltage and the last accelerator, 3A, at about 90 per cent voltage. Since the counter voltage is approximately proportional to speed, this system is a simple method for automatically accelerating the motor. Contactors for this purpose are provided with an adjustable spring or magnetic gap for presetting the closing point. Because the contactors are closed on a slowly rising voltage, they will close slowly and with light contact pressure. This method, therefore, is not generally used on controllers above 3 horsepower. Inconsistent operation will result from coil temperature variation and line voltage fluctuations. Variations in operation may be caused by load changes.

Series relay acceleration uses a relay with a normally closed contact as shown in Figure 3. This type of relay

Presented before AISE Birmingham District Section Meeting, January 28, 1946.

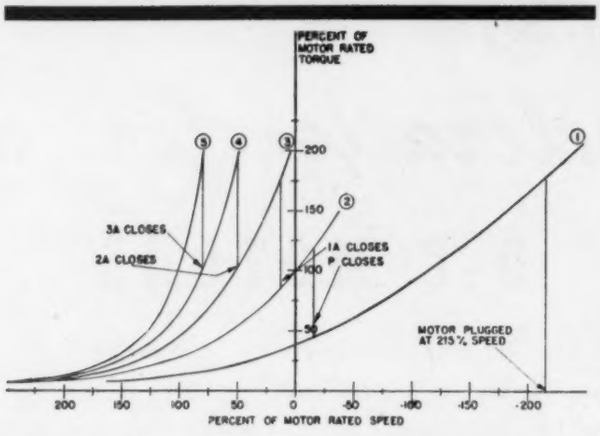


Figure 1 — These curves show the relationship between torque and speed on each master point for series wound d-c motor and starting resistor classification 152 or 162.

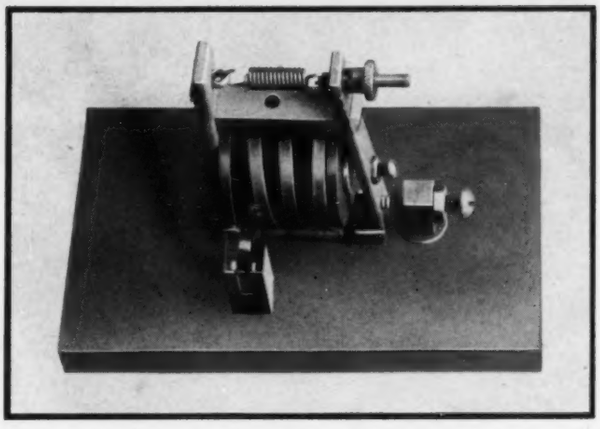


Figure 3 — Relay used for series relay acceleration control.

is designed for fast response by using a small magnetic gap and a light armature. The coil is connected in the motor armature circuit, and the contacts are arranged to handle the coils of the accelerating contactors. The relay may be set to close its contact at a preselected value of current, by the adjusting nut for the tension spring. The setting may also be changed by the adjustment of the non-magnetic armature screw which acts as a stop against the relay core. This screw should never be backed off to permit the relay armature to seal on the core.

Figure 4 shows a scheme using series relays for acceleration control. The accelerating contactor closing coils are connected in series with normally open interlocks of the preceding contactor, in addition to being in series with their respective series relay contacts. Relay 1SR is energized when the main contactor M is closed and opens its contact on the inrush current. The current decreases as the motor accelerates, and at a preset value, 1SR contact will close to energize the 1A coil. When accelerator 1A closes, it by-passes the 1SR coil and first section of resistor R1-R2. Relay coil 2SR is then energized by the next accelerating inrush current causing its contact to open and prevent coil 2A from being energized. When the current decreases again, contact 2SR will close and accelerator coil 2A will be energized. Relay 3SR will be operated in a similar manner and finally 3A will close to connect the motor directly to the line. It is important to adjust the electrical interlocks on each contactor so they do not close before their main contacts close. This is essential to insure that current is allowed to flow through the series relay coil, before the circuit is closed to the accelerator coil which it controls. If this adjustment is correct the series relay will open its contact before the accelerating contactor can function.

Series relay acceleration is reliable and has been widely used for many years. Some disadvantages are that a relay is required for each accelerator in addition to contactor interlocks. The additional equipment is undesirable from a maintenance standpoint. Since the relays must be adjusted to operate correctly for maximum loads expected, acceleration may be too rapid under light loads.

Figure 5 shows a magnetic contactor mounted on a panel with a series relay.

Figure 2 — Acceleration in this scheme is controlled by the armature counter voltage.

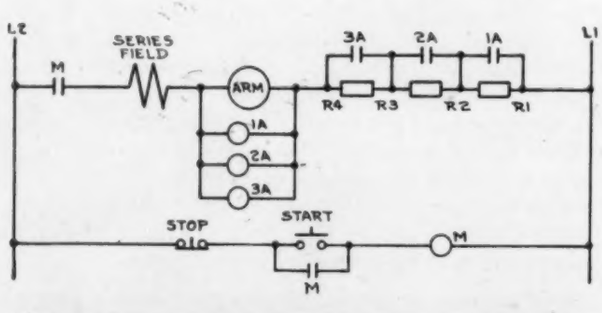
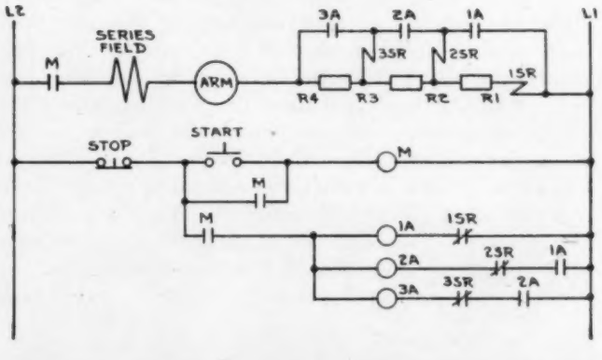


Figure 4 — One scheme for d-c series relay acceleration is shown in this diagram.



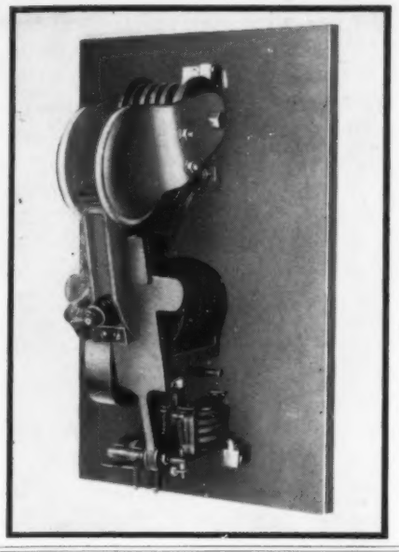


Figure 5 — On the panel is mounted a magnetic contactor with a series relay.

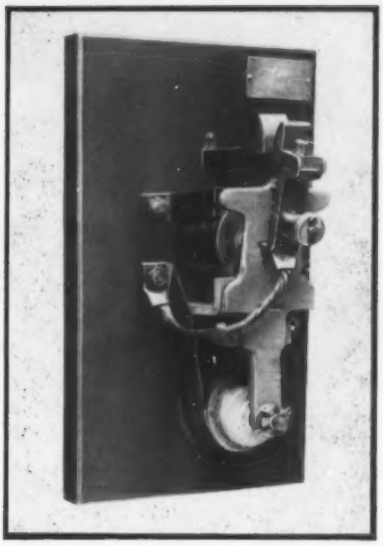


Figure 7 — In this magnetic contactor, the top coil is the closing coil and the bottom coil is the lockout coil.

A sketch of a series type contactor and the control scheme are shown in Figure 6. This contactor is designed so the flux, produced by the current through the coil, passes from the core through the air gap to the armature. Part of this flux passes through the bracket and frame to the core, and the rest of the flux passes through the tailpiece, rear air gap and frame to the core. The magnetic circuits are designed so the bracket will become saturated at a certain value of total flux. Above that value the additional flux will pass through the tailpiece and hold the contactor open. When the coil current is reduced the total flux will be decreased. As the total flux is decreased the flux through the bracket will remain approximately constant but the flux through the tailpiece will decrease until it is insufficient to hold the contactor open. The contactor setting may be changed with the rear air gap adjusting screw. A damping coil is provided around the bracket to overcome the tendency of the contactor to close, before the flux in the tailpiece becomes high enough to hold the contactor out, when current is suddenly applied to the coil. Variations in operation due to load changes will occur similar to the series relay method previously described.

One type of lockout contactor is pictured in Figure 7. This contactor is provided with two series coils, the top is the closing coil and the bottom is the lockout coil. The magnetic circuit for the closing coil has more iron in it than the lockout coil circuit. It is easily saturated and the magnetic leakage is high. The lockout coil magnetic circuit has a large air gap and the iron is not operated near saturation. More variation of pull will be obtained by the lockout coil than the closing coil if the current in both coils is varied proportionately. By proper design and adjustment, the contactor will be locked out above a certain current value, because the lockout coil is stronger. It will close just below this value because of a predominant closing coil pull. The two coils are connected in series in the motor armature circuit and the contactor will thereby close automatically as the armature current decreases when the motor accelerates.

Sometimes a shunt holding coil is mounted on the core next to the series closing coil, to help hold the contactor closed in case the current is reduced. Another variation is to use one shunt closing coil only with the series type lockout coil. This provides a constant closing

Figure 6 — On top is scheme for acceleration control with a series contactor and on the bottom is a schematic diagram of the contactor.

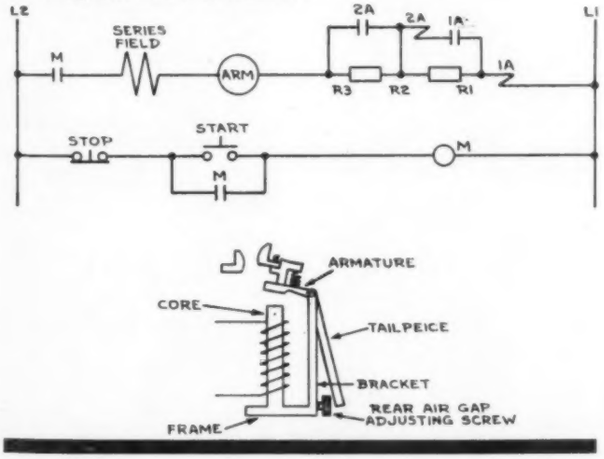
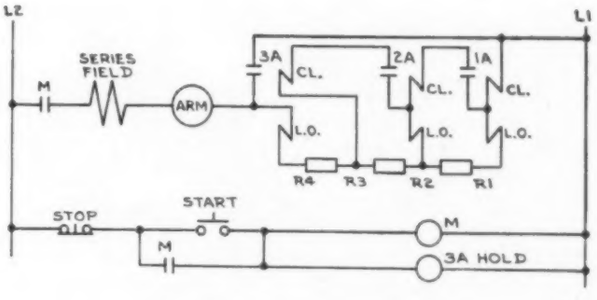


Figure 8 — Acceleration scheme using lockout contactor.



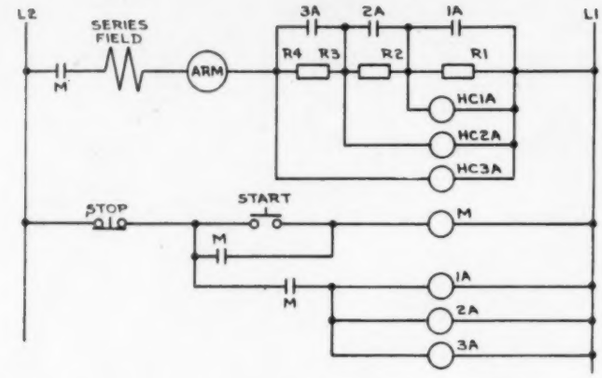


Figure 9 — Scheme shown illustrates voltage drop acceleration.

pull and permits opening the contactor by a pilot contact for regulating purposes.

An accelerating scheme with lockout type contactors is shown in Figure 8. When the main contactor M closes, the inrush current passes through the series lockout and closing coils of contactor 1A. At this current, the contactor will not close because it will be locked out by the lockout coil. As the motor accelerates, the current will decrease and at a preset value, the closing coil pull will over-balance the lockout coil pull and the contactor will close. The lockout coil is then by-passed with resistor section R1-R2 by the 1A contact. The closing of contactor 1A connects the series lockout and closing coils of contactor 2A in circuit which operates on the second inrush current similar to that described for 1A. When contactor 2A closes, the series closing coil of contactor 3A is connected in circuit. The lockout coil for 3A is connected in circuit from the time M closed, because this contactor is provided with a shunt holding coil which was energized when the equipment was started. Contactor 3A will close when the current decreases to a preset value and when it closes the motor is connected directly to the line with all the resistors and series coils by-passed. Contactor 3A is held closed only by its holding coil.

By changing coils or adjusting the disk which seats on the lockout circuit core, different operating values for the contactor may be obtained.

Because of their simplicity lockout contactors have been used on many applications. They are being superseded because load changes affect their operation and better and simpler accelerating devices have been developed.

Voltage drop acceleration may be obtained by the circuit shown in Figure 9. The contactor is constructed similar to the lockout contactor shown in Figure 7 except that both coils are shunt type. All the accelerating contactor closing coils are connected in the control circuit back of a normally open interlock on the main contactor M. The holdout coil HC1A, on contactor 1A is connected across the first section of starting resistor and is set to allow contactor 1A to close on the voltage obtained across R1-R2 when full load current is flowing through the resistors. The initial starting inrush current will be higher than full load so 1A will be held open until the current decreases to full load. The voltage across HC2A and HC3A will be greater because they are connected across additional sections of the resistor. After 1A closes, another current inrush will be obtained and this will hold out contactor 2A until the current again decreases to full load. When 2A closes, it will be followed by the closing of 3A in a similar manner.

This method merits simplicity but variations in operation will result from coil heating, voltage fluctuations and load changes.

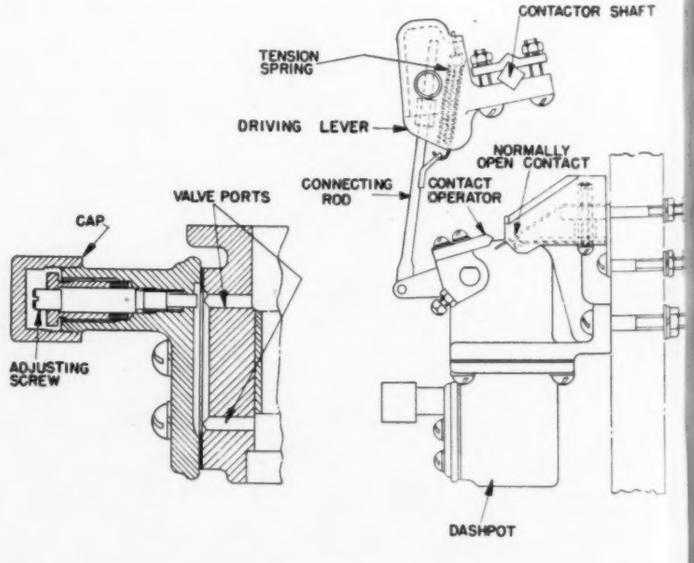
Time limit acceleration is a method in which the accelerating devices are operated in a preset time, without relation to the load on the motor or the time required for the motor to accelerate the load. The timing of the accelerating devices are not dependent upon the motor current. The principal forms of time limit acceleration are those using:

1. Inherent time of contactors.
2. Individual dashpot timing relays.
3. Multi-circuit dashpot timing relays.
4. Magnetic drag relays.
5. Escapement timing devices.
6. Inductive time limit.
7. Capacitive time limit.

A normally open mill type contactor may have an inherent time delay, of one-tenth of a second or more, from the instant the coil is energized until the contactor closes. On some high speed drives, only a fraction of a second total accelerating time is desired. Therefore, if the contactors had an inherent time delay of 0.15 of a second, three contactors would provide 0.45 of a second total time, which may be sufficient for a high speed application.

Dashpot timing relays usually consist of a piston operating in a dashpot. The dashpot may be filled with oil, mercury or air and provided with an adjustable

Figure 10 — One type of mercury dashpot timing device.



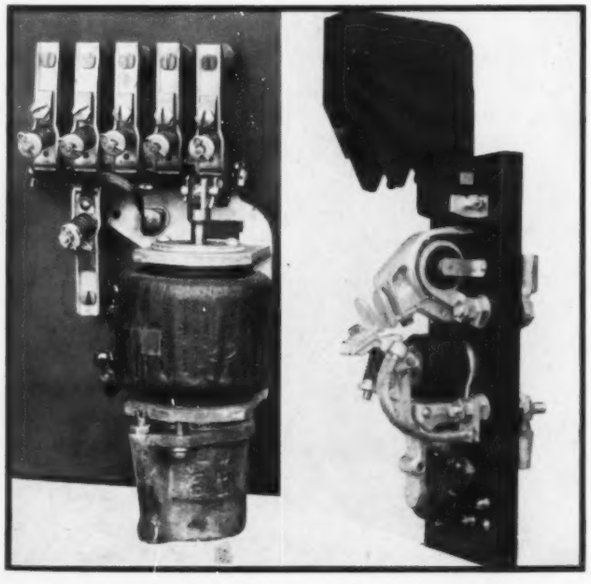
check valve for setting the timing in one direction of travel and a release valve to allow quick resetting.

Figure 10 shows one type of mercury dashpot timing device. The driving lever may be connected directly to a contactor armature or clamped to the contactor shaft as shown. When the driving lever is moved up, by clockwise rotation of the contactor shaft, the tension spring exerts a pull on the connecting rod, which is transmitted to the piston. The piston action is retarded by the mercury which must pass through the small opening in the valve ports. Near the end of the piston travel a by-pass is opened in the dashpot, which produces a snap motion at the time the contact operator strikes the contact spring. Timing adjustments are made by opening or closing the valve port by means of the adjusting screw. The sketch shows a normally open contact but a normally closed contact may be substituted. The contact is used to control a contactor and one timer is required for each accelerating contactor.

A multi-circuit dashpot timing relay for controlling accelerating contactors is shown in Figure 11. This relay is provided with a solenoid coil which produces a pull directly on the piston of the dashpot. The dashpot functions to retard the motion of the solenoid plunger in a manner similar to the mercury dashpot timing device in Figure 10. Multiple contacts are mounted on the operating arm and are staggered to operate in sequence as the plunger moves up. The contacts may be connected to accelerator contactor coils to operate them in a definite timed sequence. Each contact may be individually adjusted and the timing of the dashpot may be adjusted which makes this device quite flexible. For small sizes of motors, a timing device of this type may be used in the armature circuit to commutate the

Figure 11 (Left) — Multi-circuit dashpot timing relay.

Figure 12 (Right) — This Ltl type contactor is of 600 ampere capacity.



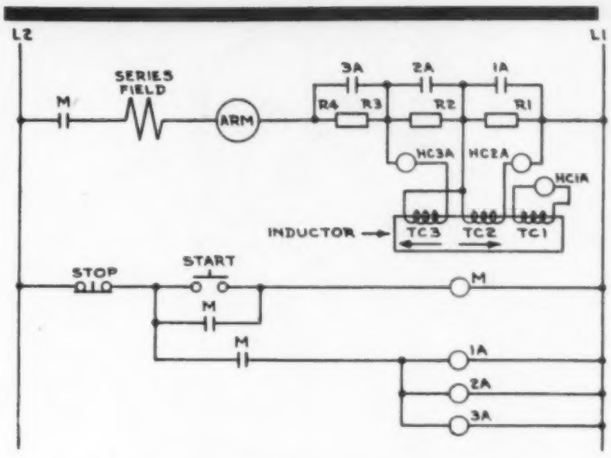


Figure 13 — Acceleration scheme using inductive time limit control and Ltl contactors.

accelerating resistor directly. With this type of timer it is not possible to open or close the accelerators individually for speed regulation.

Magnetic drag devices or escapement timing devices of different types may be used to replace the dashpot previously described for the multi-circuit dashpot timing relay.

The Ltl type QD contactor shown in Figure 12 is similar to the lockout contactor of Figure 7 as it is provided with a closing coil at the top and a holdout coil at the bottom. One primary difference, however, is that the holdout coil of the Ltl contactor is designed with a heavy iron magnetic circuit. If both coils are energized at the same time, the contactor will be locked out by the predominating pull of the holdout coil. The relationship of the two magnetic circuits are adjusted so the contactor will be held open with full voltage on the closing coil and approximately one per cent of normal voltage on the holdout coil. If the contactor is closed, it will not be pulled open with full voltage on the holdout coil. The characteristics of the holdout circuit may be changed by changing shims in back of the holdout coil or turning the knurled adjusting screw. For maximum lockout effect, these adjustments should be made to provide minimum magnetic gap between the armature and the knurled adjusting screw, and the armature and the holdout coil core. These adjustments should be made so the armature stops on the brass plug in the center of the holdout core, but an iron to iron seal at these two gaps should never be permitted. This contactor is extensively employed as an accelerator in schemes using inductive time limit and capacitive time limit control.

Original controllers for inductive time limit control using these Ltl contactors, employed a multi-coil inductor connected in the holdout coil circuit as shown in Figure 13.

Inductive time limit control and capacitive time limit control are based on the principal that the current in an inductive or capacitive circuit does not change instantaneously with a change of the applied voltage. In either of these circuits a time delay is required for the current to reach its final value when voltage is applied, or changed, and also for it to drop to zero after the

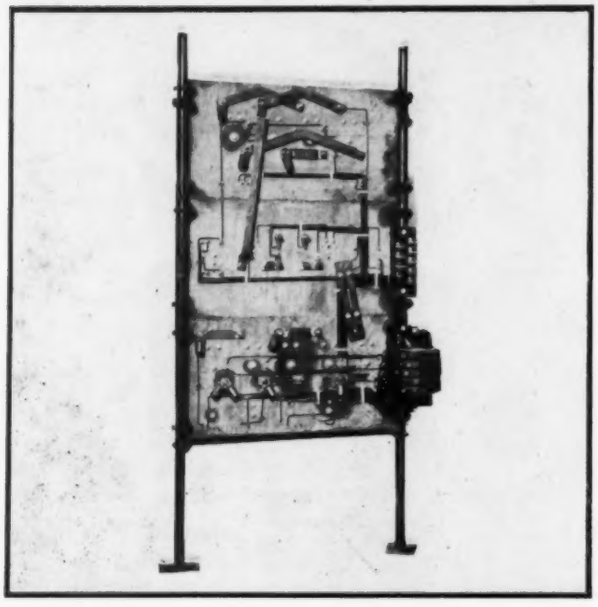
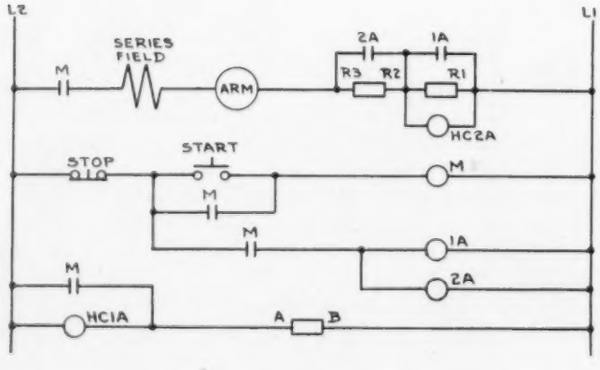


Figure 14 — Inductive time limit controllers mounted on back of panel rated at 100 hp.

voltage is removed. This principal is applied to the holdout coil of the Ltl contactor.

In Figure 13 the purpose of the inductor coils TC2 and TC3 is to add inductance in the holdout coil circuits for increasing the time delay of the contactors. When the main contactor M closes, the accelerating contactor closing coils are energized. A voltage drop is produced across the resistor steps which is connected to two of the contactor holdout coils and inductor coils. The two inductor coils TC2 and TC3 are connected to

Figure 15 — Inductive time limit control scheme without inductors or capacitors.



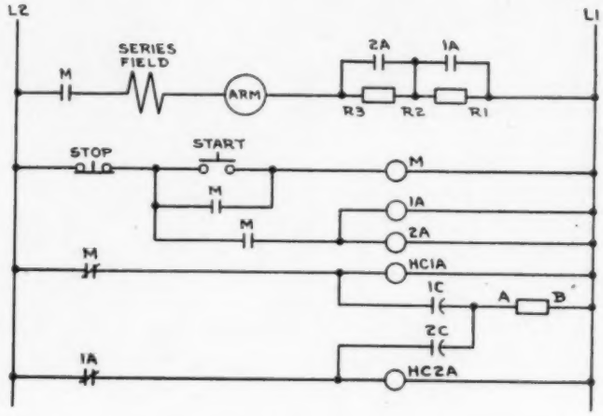
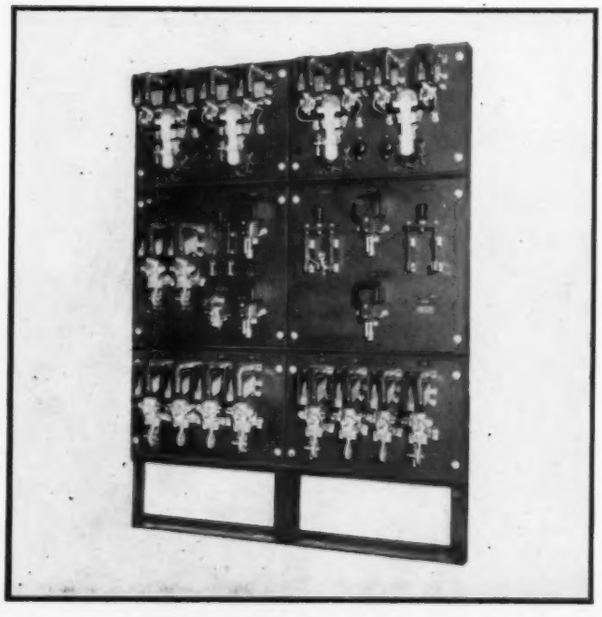


Figure 16 — Capacitors are replacing inductors on the modern Ltl controllers with large contactors.

oppose each other, but because the resistor is tapered with more resistance from R1 to R2 than from R2 to R3, a higher voltage is applied across TC2 than across TC3. A flux is thereby obtained in the inductor core, which is assumed to be in the direction shown by the arrow for TC2. While this flux is increasing, it induces a current through TC1 and HC1A. HC1A, therefore, holds out contactor 1A until the flux stabilizes at which time current will not be induced in this holdout coil circuit. Contactor 1A will then close and by-pass

Figure 17 — Timing capacitors are used on this duplex, reversing plugging, Ltl, crane bridge controller.

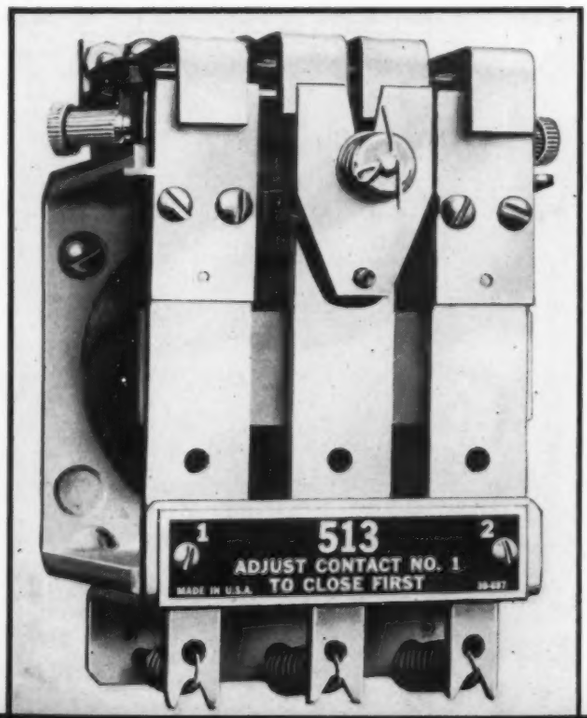


resistor R1-R2. The inductor flux will then decrease and be reversed by TC3. This change of flux will induce a current in TC2 and HC2A. Contactor 2A will remain locked out until the flux again stabilizes at which time 2A will close. When 2A closes, coils HC3A and TC3 are by-passed. Current will continue to flow through these coils until the flux has decayed to zero and then contactor 3A will close.

Inductors for this type of inductive time limit controllers are usually mounted on the rear of the panel as shown in Figure 14. On these controllers the iron in the contactor holdout and inductor magnetic circuits is magnetized above saturation. Energy input to the coils is very low for the sizes employed, which results in very little change in resistance due to normal heating. For these reasons the effect of voltage fluctuation and heating is negligible, and the controller is very consistent in operation. The relative location of the coils on the inductor and their relative polarity determine the timing characteristics of the contactors.

Satisfactory timing can be obtained on the 100 ampere and 150 ampere Ltl contactors without using the separate inductor. The inductor may also be omitted on controllers using the larger contactors if shorter timing is acceptable for the application. An inductive time limit control scheme without the inductor is shown in Figure 15. Holdout coil HC1A is energized before the start button is closed. When the start button is operated, the main contactor M is closed. Accelerator closing coils 1A and 2A are energized when one of the M normally open interlocks closes. Another normally open interlock by-passes holdout coil HC1A, but because of the inductance of HC1A the current gradually decreases to zero. Therefore, a time delay is obtained before contactor 1A closes. Before 1A closed, contactor 2A was locked out because the voltage drop from R1 to R2 was applied across holdout coil HC2A. When 1A

Figure 18 — This two pole definite time accelerating relay is designed for use with a capacitor.



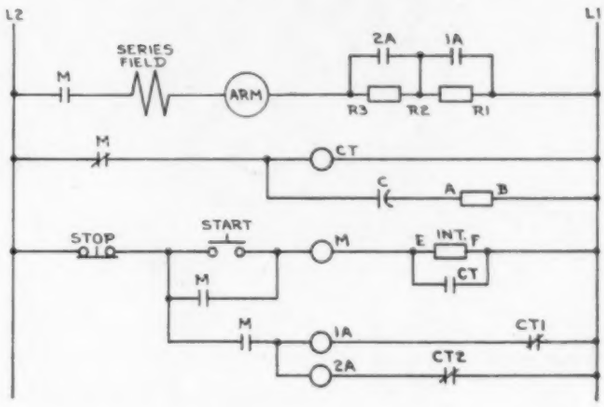


Figure 19 — Acceleration scheme using a capacitor timed relay.

closes, coil HC2A is by-passed and a time delay is obtained before contactor 2A can close.

On the present design of Ltl controllers with the larger contactors, the inductor has been replaced by capacitors. A scheme for Ltl acceleration with capacitors is shown in Figure 16. The purpose of resistor A-B, is to limit the charging current of capacitors 1C and 2C when voltage is applied. Before the start button is closed holdout coils HC1A and HC2A are energized, and capacitors 1C and 2C are charged. When the start button is operated, the main contactor M is closed. Both closing coils 1A and 2A are energized when one of the M normally open interlocks closes. The normally closed M interlock opens at the same time and disconnects holdout coil HC1A and capacitor 1C from line L2. Capacitor 1C discharges through coil HC1A and resistor AB. Coil HC1A is designed with a relatively high resistance to control the rate of discharge of capacitor 1C. As the capacitor charge approaches zero, the rate of discharge will decrease and at a preset value, contactor 1A will close. When contactor 1A closes, its normally closed interlock opens to disconnect holdout coil HC2A and capacitor 2C from line L2. This initiates the timing for contactor 2A to delay its closing the same as the closing of 1A was delayed. This capacitive time delay scheme is quite simple, reliable in operation, economical in space requirements, and requires a minimum of operating devices.

A duplex reversing plugging Ltl crane bridge controller with timing capacitors is shown in Figure 17. Non-polarized condensers are used on these controllers. They are mounted through the panel and provided with molded covers on the front of the panel.

Figure 18 shows a two pole relay designed for use with a capacitor to be used as a timing relay. The center contact is a normally open electrical interlock and the two outside contacts are normally closed. Time

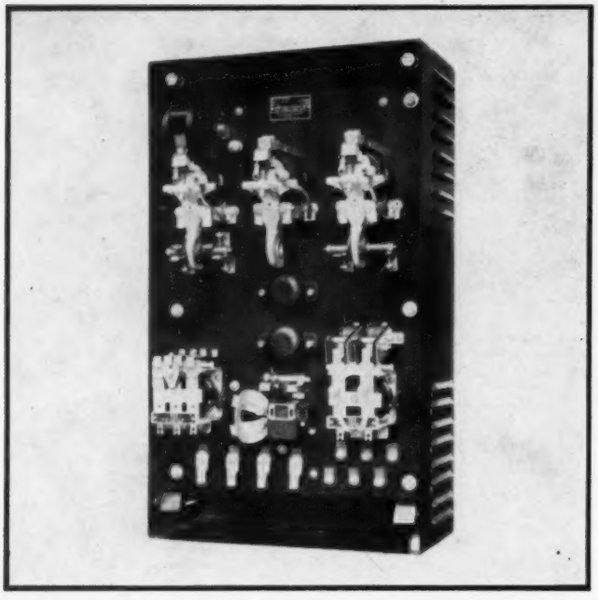


Figure 20 — Non-reversing capacitor type definite time limit starter with field relay.

of closing the two normally closed contacts may be independently adjusted with the two adjusting screws at the top of the relay. Only one coil is used on this relay and it is designed with a relatively high resistance to limit the discharge rate of the capacitor which is connected in parallel with the coil.

In the sketch Figure 19, a capacitor timed relay scheme is shown. Relay coil CT is connected with a capacitor and resistor similar to the holdout coils of the Ltl contactors of Figure 16. Coil CT is energized before the start button is closed. Interlock CT is therefore closed to by-pass the interlocking resistor EF to permit contactor M to close when the start button is operated, This interlocking is arranged to prevent energizing M. before the CT relay timing contacts CT1 and CT2 are open. When the main contactor M closes, its normally closed interlock will open, to initiate the discharge of capacitor C through coil CT and resistor AB. At the same time one of the M normally open interlocks closes a circuit for accelerator coils 1A and 2A. After a preset time, contact CT1 will close to energize coil 1A for the first accelerator. A short time later contact CT2 will close to energize coil 2A for the last accelerator. Sometime during these two intervals, contact CT will have opened to insert the interlocking resistor EF in the M coil circuit. Changes in timing due to coil heating is negligible because with this type of relay the coil wattage is very low. It is consistent in timing and can be used to control mill contactors and relays.

Normally open type capacitor timed relays are sometimes used directly for commutating shunt field resistors. Both types are shown for the non-reversing starter in Figure 20. A capacitor timed contactor of this type is used as a two step accelerator for some small sized motor starters.

At present, the definite time limit type of acceleration control is most commonly employed, because it satisfies most operating requirements. An operator easily becomes accustomed to the regular timing sequence and when several drives are being manipulated his efficiency is easily maintained at a high level.

For best performance, the type of load to be accelerated may determine whether current limit or definite time limit acceleration control should be used. If load conditions fluctuate, current limit acceleration may not be suitable because the accelerator settings would have to be set for the maximum load, and these settings may be too high for light loads. The accelerators could not be set for average loads because they may fail to function with a heavy load. Definite time limit acceleration can be set as desired and will result in consistent operation over wide ranges of load conditions. For a high inertia type constant load, requiring a long accelerating time, a current limit type accelerator would be satisfactory and may be the most economical type to employ.

A number of methods and the devices used for different types of automatic acceleration control have been described. This description, however, has been limited to constant voltage control and no attempt has been made to include special combinations for any particular application.

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By Paul H. Gast

MASTER MECHANIC

ROLLING MILL DIVISION

BETHLEHEM STEEL COMPANY

LACKAWANNA, NEW YORK

▲ SINCE the invention of the steam locomotive, the railroad rail is one of the most difficult and important problems with which the rolling mill operators have to cope. The importance of the railroad in modern times is recognized by all, and the rail is a vital part in railway operations. The increased speeds together with the increased loads have subjected railroad rail to the most severe tests. Exposed to the weather at all times, it is subject to constantly varying loads causing high compression and bending stresses, as well as shock, vibration, friction and wear.

The various preliminary operations in the manufacture of rails have undergone many changes in the past years. History tells us that, at first, wooden strips nailed to crosspieces were used as a track. Later flat iron bars were nailed on top the longitudinal wooden strips. With the development of the rolling mills, iron rails were used which are similar in contour to the present. Then when the bessemer process came into general use, railroad rails were rolled of steel. Today nearly all rails are made of open hearth steel.

One step in the finishing operation which has not changed much with the passing years, is the method of straightening rails. Rails are generally, in most rail mills, straightened with a vertical type of gag press. In the vertical method, the rail to be straightened rests in a gag press on its side for line straightening with one flange and the head of the rail resting on the anvils of the press. These presses are provided with a bottom bed, on which the rail is supported at two points from below, and a top block which moves up and down between these two supporting lines with a fixed stroke of such length that the block will not touch the rail by about two inches at its lowest point. The block has a double face, each side of which is inclined toward the center line, where the faces cut each other. This form, combined with the different dimensions of the gag, a rectangular shaped block of steel which is inserted between the face of the block and the rail to be straightened, makes it possible to control the amount of bend that the rail receives and to adapt the machine to the different dimensions of a rail. For the different sizes of rails, the faces of the blocks are made adjustable by means of set-screws and liners, while for different sections, different gags must be used. To straighten a rail, one workman is stationed in front of the machine and another at the end. By sighting along the rail, the man at the end locates the crooks in the rail and brings them under the blocks, while the man before the machine, acting under directions from the workman at the end, inserts the gag in such a way that the stroke of the machine will bend the rail enough to straighten it, which requires that the rail be bent beyond its elastic limit in order to give a permanent set.

In the vertical type press, to straighten the rails, the "gagger" inserts between the ram of the press and the rail a gag of proper thickness, the press is in continuous operation and repeats the operation, until the rail is straightened satisfactorily on its transverse axis. To straighten on the vertical axis, the rail is turned so that the base of the rail rests on the anvil of the press, and the gag is inserted between the ram and the head of the rail. In this method of straightening, the pressure of the arm as applied to the flange of the rail is not necessarily parallel to the base, but may be at an angle due to the manner in which the rail rests on the anvil of the press, with the result that it frequently causes a distortion of the edge of the rail flange. This method of gagging also mars the head of the rail at times and results in rejection and failure of the rails, because the gag usually is made narrow so as to keep its weight down to a point where it can be easily handled. The

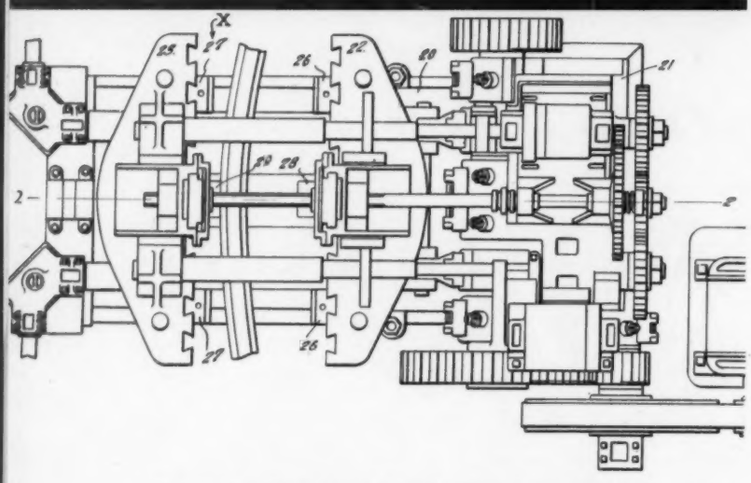


Figure 1 — Plan view of horizontal type straightener press in open position, with rail resting on its side.

method is also dangerous to the gagger in case the rail breaks and he is struck by flying pieces during the gagging operation.

Another disadvantage of this method is that the gagger relies upon a signal from the straightener on where to place the gag, and he must use judgment on how far to place the gag under the tapered head of the ram. This method frequently results in local distortion which may be sufficient cause for rejection due to the inherent stresses set up by severe treatment.

HORIZONTAL TYPE STRAIGHTENER

In 1930, the writer developed a horizontal type of press equipped with adjustable gag blocks and anvils having relatively broad faces, and so designed that the pressures are applied in line with both the transverse and vertical axis, and in such a manner that neither the flange nor head of the rails will be marred during the straightening. This method overcomes the disadvantage and defects of the usual present-day method. In the horizontal type press, all of the operations are controlled by one man. The rail may be turned and the gags operated at the will of the operator. The controls for all operations of the press may be concentrated at the central location most convenient for the operator. One of the objects in designing this type of straightener was to provide a method and operation for straightening rails whereby injury to the rails will be reduced, and the rails can be straightened in a more efficient and economical manner.

Figure 2 (left) — Vertical sectional view taken substantially on line 2-2 of Figure 1.

Figure 3 (right) — End elevation of the press.

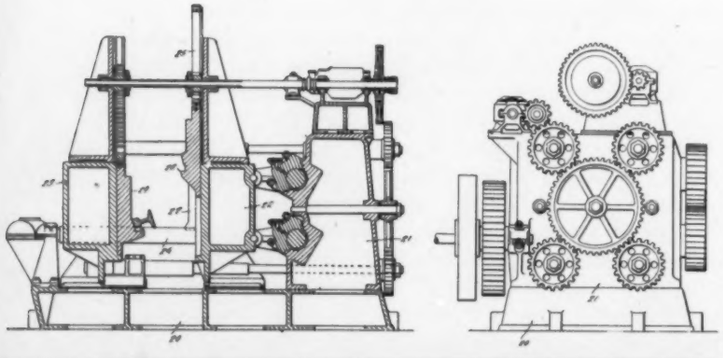


Figure 1 represents a plan view of the press in open position, with the rail resting on its side. Figure 2 represents a vertical sectional view taken substantially on line 2-2 of Figure 1. Figure 3 is an end elevational view of the press. A plan view of a rail lying on its side and having a left bend as viewed by the operator, and the relative positions of the anvils and gags for vertically straightening the rail is shown in Figure 4, as well as an end view of one rail and the relative position of the anvil and gags. In Figure 5 is shown a plan view of a rail lying on its side and having a right bend as viewed by the operator and the relative positions of the anvils and gags for vertically straightening the rail, and at the bottom is shown an end view of the rail. Figure 6 is a plan view of a rail resting on its right base and having a right bend as viewed by the operator, and the relative positions of the anvils and gags for transversely straightening the rail, and an end elevational view of the rail and the relative positions of the anvils and gags is shown in the lower part of the drawing. Figure 7 represents a plan and end view of a rail resting on its base and having a lateral bend. Figure 8 represents a rail resting on its base and having a left bend, and shows the relative positions of the anvils and gags adapted to engage the flange and the head of the rail for transverse straightening. Figure 9 shows a rail resting on its base and having a right bend, and the relative positions of the anvils and gags adapted to engage both the flange and head of the rail for transverse straightening. Figure 10 shows diagrammatic views detailing steps in the method of manipulation, whereby the rail is turned in either direction. Figure 11 is a fragmentary side elevational view of the machine showing electro-magnetic means whereby the auxiliary anvils can be operated. A perspective view of one of the anvils is shown in Figure 12.

The type of press as shown in Figure 2 is generally similar to the Taylor type and to the Lundahl type presses. The base frame 20, upright frame 21, reciprocating ram 22, adjustable head 23, rollers 24, and the mechanism for operating these various parts are similar to the Taylor press but the means 25 for operating the adjustable center gags are similar in a general way to the Lundahl press. Inasmuch as the general features of the press are generally known further description is unnecessary

The horizontal type of press is used for straightening I-beams and the like, and with the application of specially shaped anvils and gags it is adapted for the straightening of rails. The anvils and gags required to straighten a rail by the horizontal type method are of four different styles. Referring to the numbered sections in Figure 1, the two end anvils 26 are alike, and the

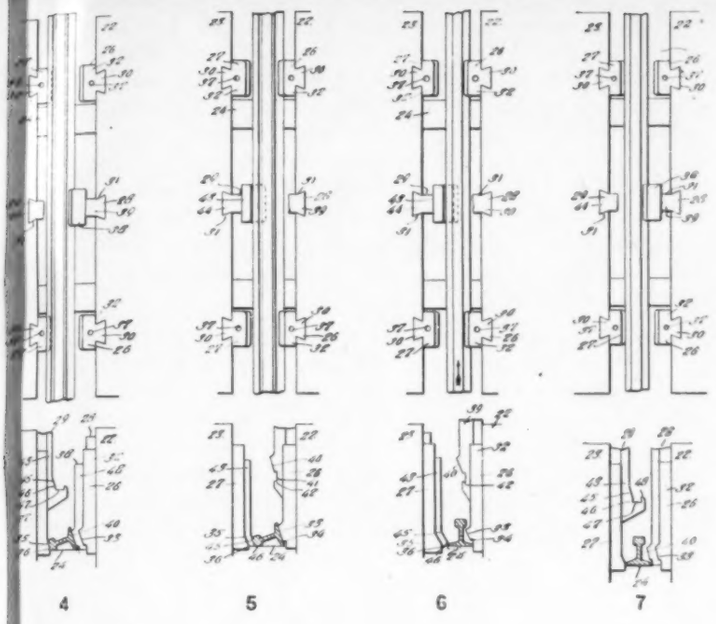


Figure 4 — Relative positions of anvils and gags for vertically straightening the rail. The rail is lying on its side and has a left bend as viewed by the operator.

Figure 5 — View of a rail lying on its side and having a right bend as viewed by the operator.

Figure 6 — View of a rail resting on its right base and having a right bend as viewed by the operator, and the relative positions of the anvils and gags for transversely straightening the rail.

Figure 7 — Plan view of a rail resting on its base and having a lateral bend as viewed by the operator, and the relative positions of the anvils and gags for transversely straightening the rail.

two end anvils 27 are alike, while the center gags 28 and 29 are both different. Anvils 26 and 27, see Figure 4, are detachably mounted in members 22 and 23 by means of dovetails 30 fitting the dovetailed slots. The gags 28 and 29 are mounted so that they are capable of sliding in dovetailed slots 31 of members 22 and 23 of the press. Only gags 28 and 29 are moved up and down during the operation, the end anvils remaining in fixed positions.

The anvil 26 comprises a rectangular body portion 32, and dovetail 30. This anvil is provided near its lower end with an angularly projecting portion 33 which is adapted to engage the base of a rail lying on its side and supported by rolls 24 as shown in Figure 5. The portion 34 is adapted to engage the base flange of the rail when standing on its base as shown in Figure 6.

Anvil 27 is generally similar to anvil 26 with the exception of its lower end. In this case, the beveled portion 35 is shaped so as to engage the head of a rail lying on its side as shown in Figure 4 and the portion 36 will engage the base flange of the rail when standing on its base. Anvils 26 and 27 are provided with tapped holes 37 for inserting lifting eyes when it is desired to change anvils.

Gag 28 comprises a rectangular body portion 38 and a dovetailed portion 39. This gag is also provided with

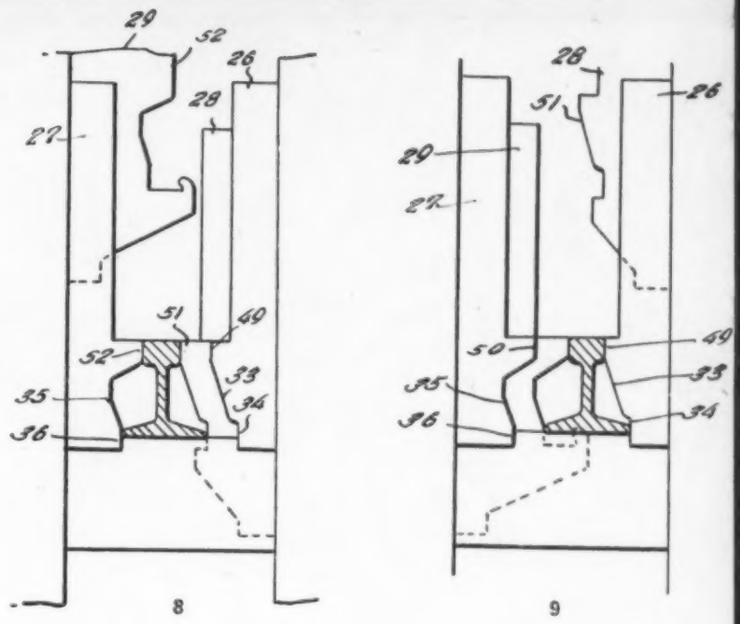


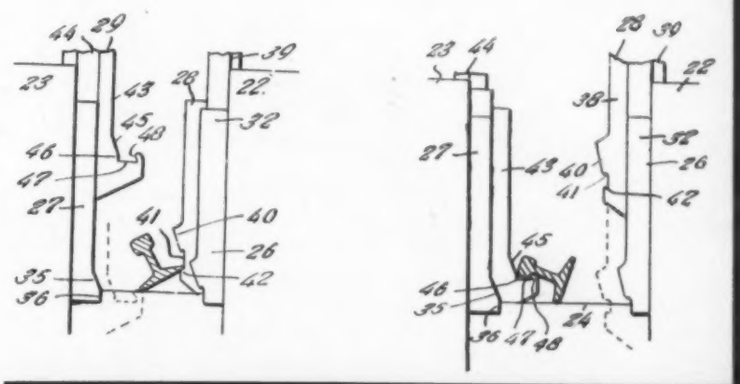
Figure 8 — Rail resting on its base and having a left bend ready for transverse straightening by the anvils and gags.

Figure 9 — Rail resting on its base and having a right bend. The anvils and gags are positioned to engage both the flange and head of the rail for transverse straightening.

an angularly projecting portion 40 which is similar to portion 33 of anvil 26. This projection is adapted to engage the base of a rail lying on its side as shown in Figure 4. Below portion 40 is a flat portion 41 which is adapted to engage the base flange of the rail as shown in Figure 5, and below portion 41 is a lip 42 for the purpose of engaging the under side of the rail base to turn the rail on its side when the gag is raised as shown in Figures 8 and 10.

Gag 29 is a rectangular body portion 43 and dovetailed portion 44. This gag is provided with a beveled portion 45 adapted to engage the head of a rail lying

Figure 10 — Diagrammatic views disclosing steps in the method of manipulation, whereby the rail is turned in either direction.



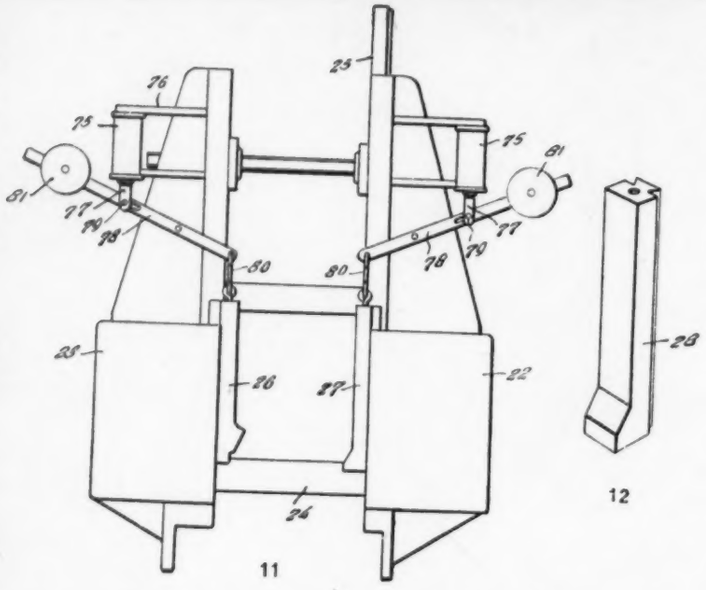


Figure 11 — Fragmentary side elevational view of the machine showing electromagnetic means whereby the auxiliary anvils can be operated.

Figure 12 — Perspective view of one of the anvils.

on its side as shown in Figure 5. Below this beveled portion is a flat portion 46 which engages the base flange of the rail as shown in Figure 6. The gag is formed at its lower end with a projecting shelf portion 47 which has a rounded and upwardly extending finger 48 which is adapted to engage the under side of the head of the rail so as to turn the rail on its base when the gag is raised as shown in Figure 10.

Figures 8 and 9 illustrate modifications of the gags and anvils just described. In this case, the anvils 26 have upper portions 49 which are adapted to engage the side of the rail head as well as the usual portions 33 and 34 for engaging the bottom and edge of the base flange. Anvils 27 are also shown with head engaging portions 50 as well as the usual head and flange engaging portions 35 and 36. Gag 28 is shown with a head engaging portion 51, and gag 29 is shown with the projecting portion 52 for engaging the side of the rail head. When using anvils and gags as illustrated in Figures 8 and 9, both the head and base flange will be simultaneously engaged on both sides of the rail when straightening for a transverse bend, and the forces are applied at right angles to the vertical axis of the rail, thereby preventing any twisting or buckling in either the head or the base of the rail. It will be understood that different gags and anvils will be used for different sizes and types of rails.

For the purpose of describing the operation of straightening a rail, let it be assumed that the rail has a transverse right bend as shown in Figures 9 and 10, and a longitudinal right bend as shown in Figures 1 and 2. The operator will be seated at a convenient point and at a height to permit the proper and clear vision of the work in hand. With the press in its opened position, the rail is fed into the press by means of driven feed rollers (not shown) on opposite sides of the press and by the rolls 24 of the press. The operator will now cause head 23 to move in the direction of the constantly reciprocating ram 22, bringing the rail to bear against anvils 26 and gag 29. As the head 23 is moved toward the rail a predetermined distance, a blow of predetermined force is struck or pressed against the base of the rail at a point midway between the two fixed anvils 26. The rail is moved in either direction by means of the table rolls, and the operation continued until the rail is straightened in this plane.

After the transverse straightening is completed, in order to turn the rail on its side from the position as shown in Figure 5 to that shown in Figure 7, head 23 is run out a short distance and gag 28 is dropped which slightly pushes the rail over until gag 28 is in the position as shown in Figure 7. The rail is now pushed into engagement with gag 28 and the gag raised to engage the underside of the rail at its edge which causes the rail to be turned on its side for vertical straightening. The head 23 is again moved in the direction of the reciprocating ram bringing the rail to bear against anvil 26 and gag 29, and a blow of predetermined force is struck or pressed against the bottom of the rail. The rail is moved through the press in either direction and the pressing operation continued until the rail is straight.

For operating the structure shown in Figure 11, an auxiliary set of anvils 26 and 27 are mounted very close to gags 28 and 29 and are to be used only to remove bends near the ends of the rails. A solenoid 75 is supported by brackets 76 above each of these anvils, the solenoids being provided with movable cores 77 connecting the rocker arms 78 by a pin and slot connection 79. These rocker arms 78 are connected by links 80 to the corresponding anvils 26 and 27 and the opposite end of the arms is provided with counter weights 81. Thus it can be seen that these anvils can be adjusted by remote control. These anvils are always above the top of a rail being straightened, except when it is desired to bring one or the other into the zone of operation for the purpose of shortening centers, necessary to remove bends near the ends of the rail.

From the foregoing description of the horizontal type press operation, it will be seen that this method of straightening rails, heretofore used only for beam straightening, is accomplished by providing gags adapted to the particular requirements for handling rails. The pressure as applied to the rail is either at right angles to the vertical axis of the rail or substantially parallel thereto. By providing mechanically operated gags, it is possible to make the faces of the gags much wider than is possible with the old hand-handled gags of restricted weight. Further, one man can control all operations and it is possible for him to straighten more rails in a given unit of time than can several men by the old vertical method. Other advantages over the vertical method are: there is no distortion along the base flange due to the use of narrow gags; the head of the rail is not marred; there is no danger of injury to the operator in case a rail should break; fewer rails are rejected by the inspectors; and the rails thus straightened have fewer inherent weaknesses than rails straightened by the hold method.

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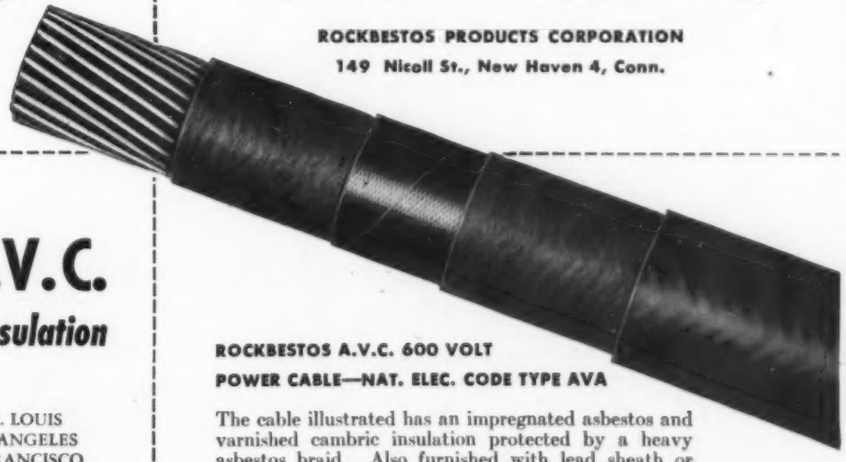

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Get Double Protection

against Motor Burnouts from Overloads or Single Phasing by installing FUSETRONS

OF COURSE, larger motors are protected with thermal cutout or overload relays. They save many motors, but experience shows that such mechanical devices sometimes stick or fail to operate—and a motor burns out.

You can give motors DOUBLE PROTECTION against burnout from SINGLE PHASING or any dangerous electrical OVERLOAD, simply *by replacing fuses used for short-circuit protection with Fusetrons* of motor-running protection size.

Fusetrons give same short-circuit protection as fuses and should thermals or relays fail to operate for any reason the Fusetrons will act independently to save the motor.

● *Why this double protection COSTS LITTLE OR NOTHING*

Large size fuses are replaced with SMALLER size Fusetrons. This means a step down in the price range.

For example: The lowest cost 100 amp. 250 volt fuse costs approximately $0.34. A 60 amp. Fusetron to replace it costs about $0.30—(BUSS Fuse Reducers to make the change possible costs but little and need never be replaced).

That is why you need not worry about the cost of replacing fuses with Fusetrons even though installing Fusetrons means that you REDUCE MANY MANY TIMES THE CHANCE OF HAVING A MOTOR BURN OUT.

On new installations you ACTUALLY SAVE MONEY because proper size switches or panels are installed instead of oversize equipment needed to take fuses large enough to hold motor starting current. The smaller size Fusetrons used further reduce costs.

● *Why Fusetrons Can Give Motor-Burnout Protection*

Fusetrons have a tremendous time-lag, due to combining a thermal cutout with a fuse. This means they can be used in a size close to the actual running current of the motor because they will not open on the motor starting current.

Ordinary fuses or circuit protection devices—because they lack sufficient time-lag, must be installed oversize to prevent their opening on the motor starting current. They can give only short-circuit protection to the wiring. They cannot operate to protect either the motor or the starter until the current flowing is far in excess of the motor-running current.

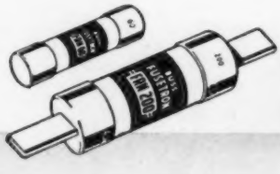
But when Fusetrons of proper size are used, any current dangerously in excess of the normal motor-running current will cause them to open. Thus they back up the overload device already installed They double the protection the motor has against burnout.

● *Provide simplest way to prevent damage from Single Phasing*

When single phasing occurs, the current flowing through the motor and through the Fusetron in the remaining phase increases about 100%. (Theoretically 73% but change in efficiency and power factor make it about 100%).

This 100% overload on Fusetrons of motor-running protection size opens them and stops the flow of current.

So to be DOUBLY SURE that motors won't be lost should single phasing occur, just replace fuses used for short-circuit protection with Fusetrons of a size near to the actual running current of the motor.



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"Our Electrical Department keeps a complete record on blown Fusetrons, giving full details on each blow, with a place for remarks by the maintenance man who makes the replacement. These records show that for the month of August, 1945, we blew 63 Fusetrons, ranging in size from 2-¼ ampere to 100 ampere, representing 43 shutdowns. From the remarks made by the maintenance men on their reports, it seems likely that probably half of these shutdowns would have resulted in burned out motors had the Fusetrons not blown."

Peter Joyce, Chief Electrician,
Joslyn Manufacturing & Supply Co.,
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What is the FUSETRON?

The Fusetron is a DUAL element device—A Fuse to which is added a Thermal Cutout.

The result is a fuse with tremendous time-lag and much less electrical resistance.

Fusetrons have the same degree of Underwriters' Laboratories approval for both motor-running and circuit-protection as the most expensive devices made. Fit standard fuse blocks.

Fusetrons are made to same dimensions as ordinary fuses and fit all standard fuse holders.

They are obtainable in all sizes from 1/10 to 600 ampere—in both 250 and 600 volt types.

Also obtainable in plug type and Tamper-resisting type (Fustats) for 125 volt circuits.

Their Cost is Surprisingly Low.

Fusetrons Protect Against Work Stoppage in Many Ways if Installed Throughout the Entire Electrical System

★ ***Entirely wipe out needless blows caused by motor starting currents or other harmless overloads***

Fusetrons have tremendous time-lag. They hold 500% load more than ten seconds whereas most sizes of ordinary fuses blow in less than one second. They won't open on starting currents or harmless overloads (heavy overloads for a short time or light overloads for a longer time). Fusetrons won't shut down a circuit needlessly.

★ ***Give thermal protection to panelboards and switches***

The thermal cutout in Fusetrons opens at 280° F. Thus if poor contact heat develops from any cause, the circuit is opened and heating stopped before damage can be done.

Ordinary fuses can't so protect because the temperature of the link must reach 786° F. before it will melt out.

Fusetrons warn that maintenance is needed instead of permitting panel or switch to be damaged by poor contact.

★ ***Prevent needless blows caused by heating in panels and switches***

Fuses have 55 to 140% greater electrical resistance at full load than Fusetrons, hence Fusetrons produce less heat than any fuses. They eliminate useless shutdowns caused by fuses running too hot.

★ ***Permit use of larger motors or adding more motors on circuit WITHOUT installing larger switch or panel***

The operating load on Fusetrons can be close to their ampere rating because Fusetrons hold starting currents—but ordinary fuses must be installed oversize because they lack sufficient time-lag to hold starting currents.

By replacing oversize fuses with Fusetrons, you can load panels or switches near their capacity. A larger motor or additional motors can be installed without the trouble or expense of changing the panel or switch.

★ ***On new installations, use Proper size switches and panels instead of oversize***

With ordinary fuses, switches and panels must be oversize because fuses larger than the operating load must be used to hold starting currents.

But Fusetrons hold starting currents, therefore, PROPER size switches and panels to fit the load can be installed, saving money and space.

★ ***Double burnout protection for large motors (See opposite page)***

★ ***Make protection of SMALL motors simple and inexpensive***

Install a Fusetron of proper size anywhere in the circuit to handle ONLY the motor current—that's ALL.—to safeguard against trouble and cost and lost work caused by the burnout of even a SMALL MOTOR.

★ ***Protect coils, transformers and solenoids against burnout***

Install a proper size Fusetron. It won't open on harmless overloads or normal current surges, yet should a dangerous overload occur for any reason it will cut off the current to prevent a burnout.

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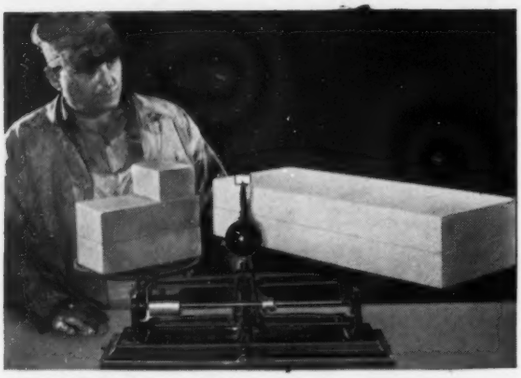

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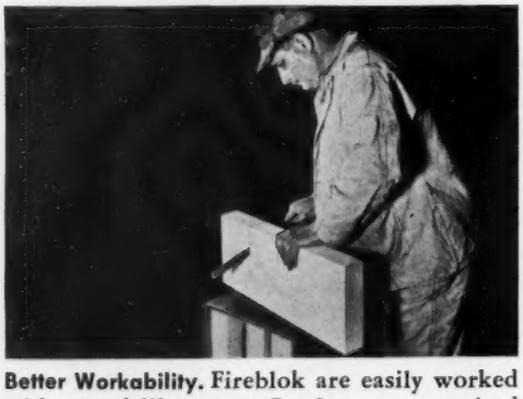

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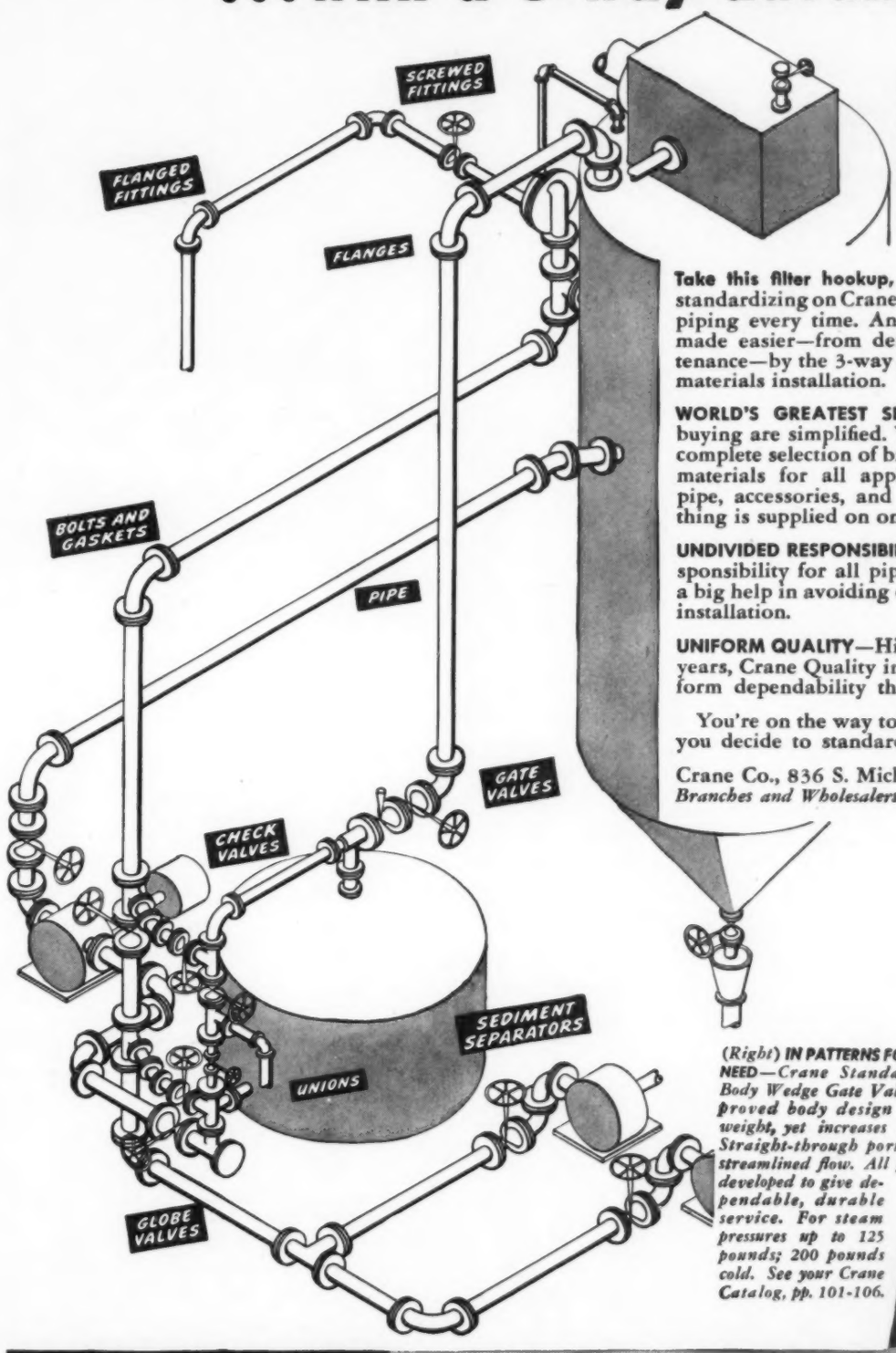

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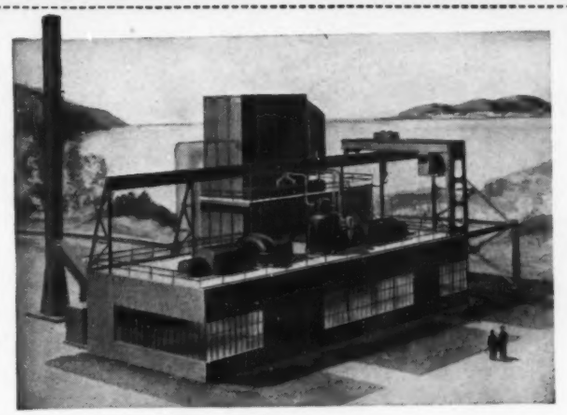

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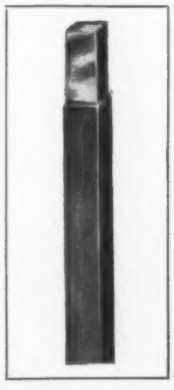

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A complete line (round, square, and rectangular) for winding and rewinding motors and other equipment requiring Class B insulation. Close-tolerance layer of purified asbestos takes bending without rupture.

*Trade-mark Reg. U. S. Pat. Off.

GENERAL ELECTRIC

The picture above shows a view of the wash-oil still, continuous forerunnings and nitration-benzol columns and batch toluol-xylol still with kettle.

This view shows the general arrangement of the wash-oil distillation and light-oil refining plant. There is wide substitution of concrete for locally scarce steel.

the first

light oil refining plant in South America

PRODUCING PURE BENZOL, TOLUOL, XYLOL AND SOLVENT NAPHTHA

leads to another

This is the first plant in South America for the recovery and refining of light oil, and, since its construction was started, Koppers has received an order for a similar plant for the Societe Anonyme du Gaz de Rio de Janeiro, where benzol was never previously recovered.

This first plant is at the Companhia Siderurgica Nacional, Volta Redonda, Brazil. It has a capacity of 5,000 gallons of light oil per day. It is designed to produce 100% pure products, and is equipped with a Koppers Continuous Automatic Wash Oil Purifier. It is now in production.

This plant, and the new one at Rio de Janeiro will go a long way toward relieving Brazil of the necessity for importing these aromatic oil products.

KOPPERS

THE INDUSTRY THAT SERVES ALL INDUSTRY

KOPPERS COMPANY, INC., Engineering & Construction Division, Koppers Building, Pittsburgh 19, Pa.

SERVICE TO STEEL MILLS by LINK-BELT

Complete line of Chains for transfer tables, coil conveyors, furnace conveyors, feeder and catcher tables, sheet pilers, draw bench and other equipment . . . Elevators and Conveyors of all types, such as belt, bucket, screw, flight, Bulk-Flo, drag chain, apron, Sidekar-Karrier, trolley, Oscillating-Trough, etc. . . . Vibrating Screens . . . Dryers and Coolers . . . Skip Hoists . . . Car Dumpers . . Car Spotters and Haulage Systems . . . Portable Conveyors and Bucket Loaders . . . Traveling Water-Intake Screens . . . Automatic Stokers . . . Silent and Roller Chain Drives . . . Speed Reducers and Increasers . . . Variable Speed Transmissions . . . Sprockets . . . Gears . . . Clutches . . . Couplings . . . Babbitted, Ball and Roller Bearings, etc.

LINK-BELT CONVEYORS MOVE coils smoothly . . .

Link-Belt conveyors are especially designed to move and transfer coils smoothly — and without edge damage. While built in a variety of designs for specific production problems — the basic thought in ALL designs is the reduction of scrap losses due to strip damage.

Ample bearing surfaces carry the coils smoothly — without telescoping. Rugged construction, conforming to steel mill requirements, eliminates delay and allows low operating costs.

Mill equipment by Link-Belt means a complete Link-Belt service... design, manufacture and installation. As pioneers in the development of materials handling in the steel industry, you can look to Link-Belt for practical, proven cost-reducing mechanization.

LINK-BELT COMPANY

Chicago 9, Pittsburgh 19, Cleveland 13, Detroit 4, Indianapolis 6, St. Louis 1, Kansas City 6, Mo., Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in Principal Cities.

10,282

LINK BELT CONVEYORS

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NEWS SUPPLEMENT August, 1946

Equipment
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Iron AND Steel ENGINEER

ENGINEERING SERVICE TO THE IRON AND STEEL INDUSTRY SINCE 1907

EXTENSIVE IMPROVEMENTS IN OHIO PLANTS OF YOUNGSTOWN SHEET AND TUBE COMPANY

▲ New equipment is being installed and some of the present equipment is being modernized to boost production in Youngstown district plants of The Youngstown Sheet and Tube Company.

In addition to this work, extensive repairs are being made to equipment which was too busy during the war years to go down for periodic overhauling.

The 1946 improvements program includes:

Two new ore bridges to replace the present ore bridges at Campbell, Ohio. They will be finished about November.

New slitting equipment has been purchased and will be installed to produce about 75,000 tons a year of narrow cold rolled steel, up to 12 inches wide.

A new welder is being installed in the cold strip continuous pickling department which will permit producing heavier coils. This will be finished this summer and will give the department two continuous pickler lines with welders.

Another small electric weld tube mill is being installed at Struthers, Ohio, to produce 8000 tons a year of conduit and electric weld tubing.

Equipment is being installed at Struthers to boost production of cold drawn bars in smaller sizes up to ¾ inches.

Modern precision equipment is being installed to produce couplings for large size oil country pipe and new equipment has been installed to make couplings for pipe up to two inches.

Work which has been in progress for some time and will be completed in the near future, includes:

The cold strip expansion program has been in progress since last fall. It will increase capacity 40 to 50 per cent.

Work is being completed on the bridge ramp and truck parking space at the cold strip shipping department to better handle trucks. When this is completed the department will be able to handle 100 trucks a day.

Equipment is being received and installed at the Struthers plant to manufacture an additional 1000 tons a month of the highest grade of fine wire. This will not be completed until the end of the year. Heat treating facilities also are being installed.

Company officials took advantage of the coal strike and the shutdown of mills to make immediate repairs to some of the equipment. Other repair work, modernization and changes are in progress. They include:

Relocating the 75-inch temper mill and a 75-inch shearing and trimming line to give more stock space ahead of the cold reduction mills. This will be finished in about a month or six weeks.

Major repairs have been made to the hot strip mill, which required removing two of the biggest stands.

One hot strip reheating furnace has

HYDRAULIC PRESS OFFERS SAVINGS

Several open hearth shops are making substantial savings through the installation of compact hydraulic press in the open hearth department for straightening stopper rods. The unit shown here, made by the A. B. Farquhar Company is a 15 ton oil-hydraulic press and occupies a floor space of 4 ft x 20 ft. It is 93 in. high overall, is powered by a 5 hp pump unit, and is equipped with spring supported roller blocks for feeding and checking the work, and with pressure blocks for straightening.

Installations of this type in the open hearth department have eliminated transportation to and from the blacksmith shop, as well as the delays caused by the latter procedure. Also, the work is done with open hearth labor, eliminating the higher priced shop labor and overhead. ——E-40

been modernized and the other two will be modernized. Changes in design and installation of complete automatic controls will increase production about 10 per cent. The furnaces will be able to use coke oven gas, natural gas, fuel oil or tar efficiently.

Rehabilitation of all six coke batteries at Campbell, Ohio, has been completed. General repairs were made to door jams. New collector mains and new liquor flushing systems were installed.

Minor changes have been made in the open hearth department to slightly increase the size of heats. Nine of the 12 ladles have been replaced with larger ladles and the other three will be replaced soon.

New housings were installed on the blooming mill and some of the mill tables. Minor changes were made to auxiliary equipment.

Repairs are being made to the blast furnaces and coke plant at Brier Hill.

I DESIRE MORE INFORMATION

Included in this section is a coupon which can be used by you in obtaining additional information on any article that appears in the News Supplement. At the close of each item, on which information is obtainable, appears a key reference number (Example: E12 or NEB56). Simply mark the reference number on the coupon, complete your address data and return to us.

LEAK DETECTOR TESTS TRANSFORMER COVERS

▲ A leak detector, an instrument normally used to locate leaks in vacuum systems, was recently used in a novel application by General Electric Company engineers working with the Consolidated Edison Company of New York, when three large special transformer covers were replaced with new ones made of aluminum.

Each cover had 177 gasketed studs through the plate, and each stud had to be tested for oil-tightness. It was possible to use air pressure and a soap solution on each stud to detect leaks, but it would have been a long job and the soap solution might have penetrated under the head of some studs, ultimately contaminating the oil inside the transformer when the covers were finally installed.

Use of the leak detector brought to light a new application for the instrument, and solved the problem quickly and accurately. Since the leak detector indicates the presence of helium, a can of this gas under pressure was applied to the head end of a stud under test and the valve opened to put approximately two pounds pressure of helium around the stud. Over the threaded end of the stud on the other side of the cover plate was placed a suction cup with a rough vacuum in it, and the leak detector was connected to the cup through a valve.

Any helium which was sucked through the gasketed stud hole in the plate was indicated on the output meter of the leak detector. If after 30 seconds no reading was seen on the meter, the valve on the helium can was closed and the can was removed from the stud. At the same time, the operator of the suction cup released the cup from the other side of the plate and the test crew was ready to start the sequence over again on the next stud.

Since the rubber gasket around the edge of the helium can was not absolutely helium tight, an electric fan was trained on the can to disperse any concentration of helium which might have been carried through the air to the leak detector. This was especially useful when the helium can was used on studs near the edges of the cover or near one of the large openings in the cover.

After becoming familiar with the testing procedure, the test crew of three men cut the time of testing a cover plate with the leak detector from three to two days, and by using this method obtained accurate results without the danger of contaminating the oil in the transformer with a soap solution.

—E-41—

Each of the transformer cover plate's 177 gasketed studs had to be tested for oil-tightness.

CLAIRTON CHARGES COAL IN REBUILT COKE PLANT

▲ Completion of the rebuilding of battery No. 22 at the Clairton by-product coke plant was marked by the charging of the first coal into the ovens July 25, it was announced by Carnegie-Illinois Steel Corporation.

Since June 1 the slow, careful process of bringing the rebuilt battery up to the required heat for charging coal has been going on. Temperatures have been increased from day to day at a variable rate over the seven-week period by use of coke oven gas generated in other batteries at the Clairton plant.

The new battery consists of 87 Koppers-Becker underjet type coke ovens with self-sealing doors and double collecting mains, first ovens

of this type to be erected at Clairton. It has a total carbonizing capacity of 2500 tons of coal a day, while the entire Clairton plant, largest in the world, has a daily coal carbonizing capacity of 30,000 tons.

Now that battery No. 22 is completed, the Koppers Company, which was awarded the contract for rebuilding batteries 21 and 22, will commence rebuilding battery No. 21 immediately.

—E-42—

COLUMBIA STEEL SPEEDS COLD MILL CONSTRUCTION

▲ Construction of Columbia Steel Company's new $25,000,000 cold reduction steel sheet and tin-plate mill at Pittsburg, California, is proceeding on schedule, it was announced recently.

Already, preliminary grading has been completed and the pouring of concrete foundations is scheduled to start within the next few days. Work also is progressing on the laying of 80,000 lineal feet of pipe, ranging from 36-inch sewers to 1-inch gas and air lines.

On adjacent New York Slough, the construction of deep water docks for ocean vessels and barges is underway. Similarly the laying of 40,000 feet of railroad trackage has begun.

Actual erection of buildings is expected to start in September. When completed next year the new mill, which will be located in the center of Columbia's present 400-acre plant, will be capable of producing approximately 500,000 tons of steel sheets and tin-plate. This will mark the first time cold reduced sheets and tin-plate have been manufactured on the Pacific Coast.

Orders for some 27,000,000 pounds of machinery have been placed. This equipment includes one 56-inch, 5-stand, 4-high cold reduction mill; two 2-stand tin-plate tempering mills; one single-stand sheet tempering mill; two continuous electrolytic cleaning lines; three tin-plate shearing lines; a tin-plate side trimming and reshearing line; tin-plate and sheet coil annealing equipment; sheet shearing and processing equipment for sheet and drum stock; continuous pickling lines; fourteen hot-dip tinning units; one continuous electrolytic tinning line and auxiliary equipment; a sheet galvanizing line, and twenty-one utility cranes.

PROBABLY one of the most distinct advantages that Mathews makes available to industry today is a conveying service that is complete. Proposal engineering, estimating, detail engineering, fabrication, and erection in the field, all are part of this thoroughly organized effort. A competent field engineering staff, an experienced engineering force at the plants, modern factories and highly skilled personnel make this complete service possible. Plant engineers have learned that this complete service can make the material handling phase of their job easier, and help them to do it better.

When you need conveying equipment, remember that Mathews complete service can be yours for the asking, without obligation. Whether your problem requires gravity or power conveyers, or special conveying machinery, you will find Mathews Engineers in a position to help you make the most practical application.

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for round bar and tubular products

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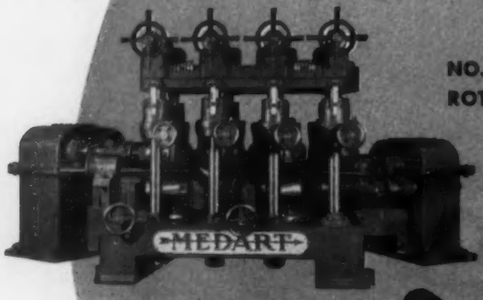

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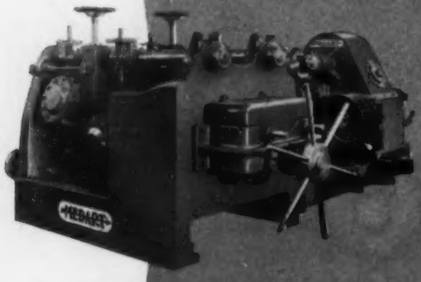
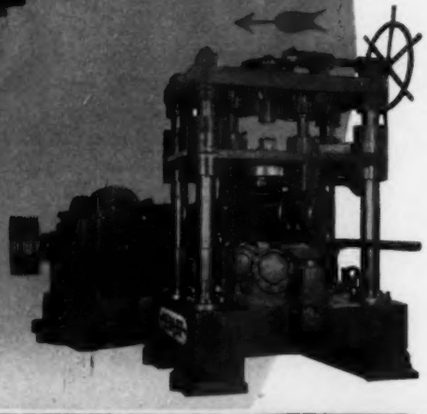


NO. 3 SIZE MEDART THREE ROLL ROTARY STRAIGHTENING MACHINE



MANUFACTURING ENGINEERS OF COMPLETE TRANSMISSION EQUIPMENT AND SPECIALIZED MACHINERY

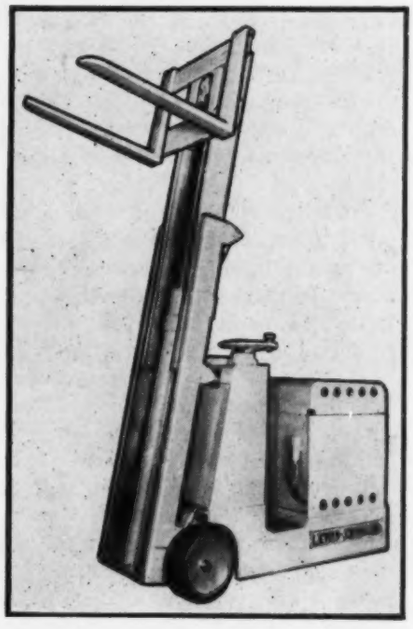
MEDART

THE MEDART COMPANY 3400 DE KALB ST. ST. LOUIS, MO.

NEW POWER FORK TRUCK TURNS IN 12-FT AISLE

▲ Conservation of aisle width and consequent annual earnings due to increase of available storage or production space are claimed for the 4000 lb capacity electric power fork truck manufactured by Lewis-Shepard Products, Inc. Using a 48 inch fork and carrying a 48 inch load, this truck will enter an aisle 12 ft wide and, in one continuous forward travel of the truck, make a single right angle turn and right angle stack, with no backing or filling.

This very efficient operation is only possible in this 12 ft aisle width with a power fork truck which possesses the three outstanding features of this electric fork truck: (1) An equally short turning radius; (2) An extremely low center of gravity; (3) An overall length no greater than this Lewis-Shepard Truck (measuring from the rear of the truck body to the forward point of the 48 inch fork and load).



This truck will make a single right angle turn in a 12 ft aisle with no backing or filling.

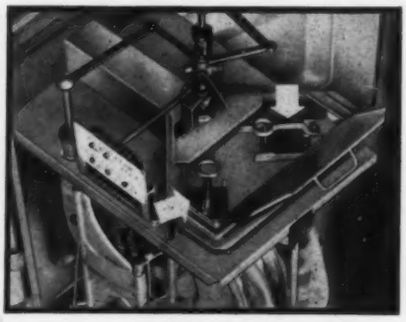
These three features of limited overall length, short turning radius, and low center of gravity provide maximum maneuverability under all conditions. By operating in a minimum aisle width this electric fork truck saves floor space which, it is

estimated, costs from $5 - $7 per square foot when you build. In addition to its minimum overall length and short turning radius, this truck has inherent stability when making abrupt turns and when elevating or lowering a load.

—E-43—

CARBON GRAPHITE VALVES HAVE SELF-LUBRICATION

▲ "No Drag" valves eliminate most problems usually encountered in gas meter valve operation. They are constructed of carbon-graphite, a material offering outstanding advantages in this and similar applications. Chief advantages of these valves are self-lubricating characteristics that lengthen the life of both the valve and mating surface; immunity to chemical attack; dimensional stability that provides dependable accuracy and complete freedom from gumming, sticking or warping and are quiet in operation. Because of these features, these valves eliminate "DPG" meters due to valve freezing or broken wrist pins.



The valves are supplied in slide or circular motion types for all makes of meters. These valves are a product of Morganite, Inc.

—E-44—

FOLLANSBEE LEASES PARKERSBURG PLANT

▲ Follansbee Steel Corporation announced that it has concluded negotiations to lease the steel production equipment and the mill section of The Parkersburg Steel Company plant, Parkersburg, West Virginia. Follansbee will produce motor and dynamo electrical sheets, largely for the Parkersburg Steel Company who will operate the fabricating section of the plant. Follansbee will have limited production for the trade.

The Parkersburg Steel Company formerly was the Parkersburg Iron and Steel Company. The plant has an annual potential capacity of 36,000 tons of hot rolled electrical sheets. There will be approximately the same number of employees as before the plant was closed. Union contracts already have been negotiated.

NATIONAL TUBE IMPROVES GARY AND LORAIN WORKS

▲ An extensive program of improved new facilities at the plants of National Tube Company at Lorain, Ohio, and Gary, Indiana, was announced to enable that company better to meet the estimated future demands for steel pipe.

An entire new Bessemer steel plant, including three Bessemer converters and all necessary auxiliary equipment, will be installed at Lorain to replace the existing Bessemer steel facilities in that city. The new plant will increase National Tube's ingot capacity at Lorain from 1,884,000 tons to approximately 2,200,000 tons a year. In recent years there have been many improvements in the methods of producing Bessemer steel, resulting in a strong market demand for products made from the steel produced in these fiery sentinels, long identified as landmarks in steel-making areas.

The improvements at Lorain also include the installation of an additional mill to produce seamless pipe in the smaller sizes; additions and improvements in the equipment for the production of pipe and boiler tubes; a blooming mill, a bar mill and a billet mill replacing two existing blooming mills and a combination rail mill. These developments will increase the pipe capacity of Lorain Works to the extent of approximately 150,000 tons annually, or around 15 per cent.

At the Gary plant where certain Government-owned equipment in-

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stalled during the war was recently purchased by National Tube, an additional seamless mill for the production of small-size pipe will be installed, as well as electric welding equipment for producing tubing up to 5-inch outside diameter. These new facilities when integrated with presently-owned equipment, will increase National Tube's pipe and tube capacity at Gary by about 170,000 tons a year.

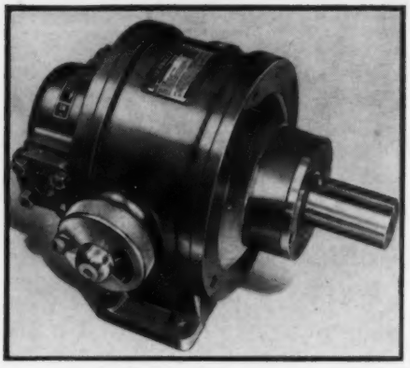
It is estimated that completion of these two projects, soon scheduled to start, will require about two years. It is expected that the new facilities, when completed and in operation, will provide additional employment at both Lorain and Gary.

NEW HYDRAULIC MOTOR FOR DIRECT DRIVE

▲ Production of a new type of industrial hydraulic motor, combining high starting torque with turbine-smooth power, has been announced by Superdraulic Corporation. This development, known as the "Triport" motor, parallels the company's line of high pressure hydraulic pumps, making available a perfectly balanced combination of pumps and motors, each designed to insure efficient operation when combined as a complete power transmission system.

This, according to the company, is the first time in the history of hydraulic devices that ample power for most machine applications has been available from so compact a unit — the 47 hp motor is only 10½ inches in diameter and light enough to be easily handled by one man. Torque range is as high as 200 lb-ft. The motor is available in two types, one rated at 26½ gpm with 3500 psi, input at 1200 rpm; the other at 19 gpm with 5000 psi at 1200 rpm.

This newly-announced motor is said to hold many advantages for industrial machine applications, including infinitely variable speed control, forward and reverse, by means of a convenient finger volume control valve; starting without clutches; and perfect control of acceleration and deceleration. Because of its unique design, which provides 66 power strokes per revolution, the motor is said to have turbine smoothness.



This newly-announced motor holds many advantages for industrial machine applications.

The compactness of the new motor makes direct drive available for many machines which have had to forego this modern type of power application because either electric motors or

GRAPHITE GUS SAYS:

GRAPHITE THRIVES ON HEAT AND PRESSURE

...that's why DIXON'S GRAPHITE ROLL NECK GREASES Cut Wear, lessen machining, save "down" time and power costs

These special made-for-the-purpose roll neck greases stand up where ordinary greases fall down. The lubricating graphite in them will not squeeze out and is virtually immune to heat. They lessen repairs and replacements. Dixon's Graphited Roll Neck Greases lubricate longer—and reduce power costs. Get them for your roll necks—and any other spot where you fight extreme heats and pressures. Send for folder "ROLL NECK LUBRICATION."

JOSEPH DIXON CRUCIBLE COMPANY

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NATURALS FOR "HOT SPOTS"

DIXON'S LUBRICATING FLAKE GRAPHITES... All screen sizes. To apply dry, or to fortify oils and greases, and to coat pipe joints and gaskets. Data Sheets Nos. 5, 6, 7 tell the uses.

DIXON'S GRAPH-AIR GUN, Filled with Microfyne Graphite... A dry graphite ejector to lubricate hard-to-reach mechanisms, locks, jigs, tools. Data Sheet #8 gives details of this effective little lubricator.

DIXON'S GRAPHITE SLIPSTIK... This wax-like lubricating stick is used like a crayon for fast rub-on lubrication. Data Sheet #23 tells why it is indispensable for certain uses.

DIXON'S GRAPHITED OILS AND GREASES... Ready-to-use, fortified with Dixon's lubricating flake graphite, provide sustained lubrication for longer periods, especially under extremes of heat and pressure. Data Sheets #13 & 14 tell about Cup Grease and No. 677.

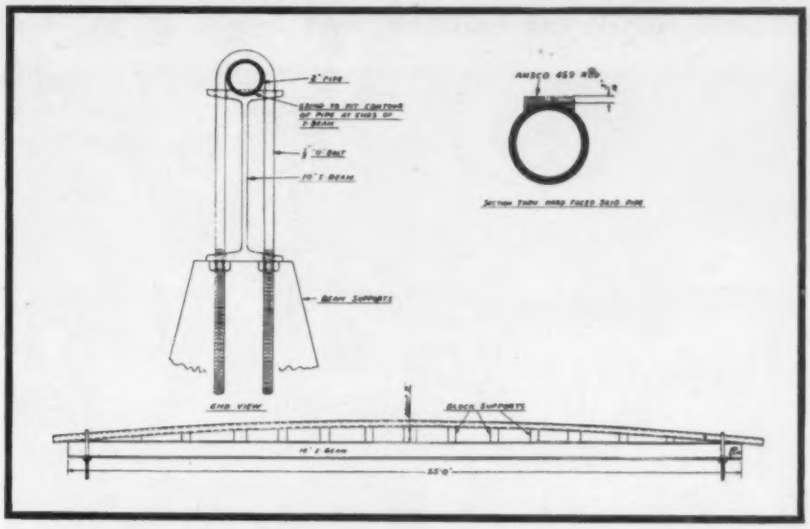
DIXON'S DATA SHEET DIRECTORY
Add to Your Knowledge of Graphite and to your Reference File
DIXON'S ILLUSTRATED DATA SHEETS

Write Graphite Gus for any of above Data Sheets and Data Sheet Directory listing 11 other friction-fighting graphite products.

hydraulic motors necessary to meet power requirements were too large and bulky to be built into the machine.

Another difficult problem, which is solved by the Superdraulic motor, is the application of power in plants where other types of power may represent a fire hazard. In mills where a high dust content in the atmosphere represents a constant danger, hydraulic power offers a perfect and simple solution. Hydraulic pressure generated by pumps, located outside the danger area, is readily transferred by means of tubing to the two hydraulic motors mounted as direct drive units.

—E-45—



This sketch shows the application of the gas welding rod which has increased the life of rolling mill furnace skid pipes.

WELDING ROD LESSENS SKID PIPE MAINTENANCE

▲ Maintenance of billet-heating furnace skid pipes in rolling mills has been a painfully costly item — one of those conditions for which an effective remedy must be developed sooner or later. Figure 1 shows the application of Amsco No. 459 Welding Rod, gas-welded which has increased the life of rolling mill furnace skid pipes from the usual six to eight weeks to 16 to 18 months. Hard-surfacing the pipes with No. 459, adapted to resist severe abrasion, also reduces proportionately the disruptions of production which occur when skid pipes develop leaks from wear.

To reduce surface checking and control warpage when applying No.

IMO— The PUMP for SMOOTH FLUID FLOW

The steady, uniform flow produced by the rotors in an IMO pump is ideal for oil burner supply, hydraulic service and other applications requiring an even, smooth flow of fluid.

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FOR A GROUP OF OIL BURNERS OF SMALL CAPACITY

BLOOM UNIT ATOMIZER

Provides a Method of Burning Small Quantities of Heavy Fuel Oil at Each Burner

The atomizer operates on high pressure steam. It atomizes a reasonable quantity of oil and then divides and distributes this quantity into equal parts, which are delivered to a number of small burners.

An easy system to control. A workable method for a combination oil/gas application to small gas burners. Suitable for oil application to burners requiring 1½ to 3 g.p.h.

BLOOM ENGINEERING CO.
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ROLLING HOOP THE MODERN WAY

Rolling a hoop was always more fun than carrying it. The Sharon Steel Corporation has found that battery-powered industrial trucks rolling around in its Sharon, Pennsylvania, plant have brought savings both in time and effort. The illustration shows one of this company's fleet — a 7000-lb capacity ram truck — rolling down a plant aisle with sixteen wrapped "hoops" of stainless steel strip, headed for the shipping room. The weight of the load is about 4000 pounds. Other electric trucks in the fleet are used for transportation of all products, inter-department handling, loading and shipping.

—E-49—

459 to skid pipes, prebending of the pipes is recommended. After the skid has been bolted in place on the I-beam, that portion of the pipe surface to which the welding rod is to be applied should be ground to remove mill scale, rust, etc. A larger torch tip than for ordinary welding and a neutral oxyacetylene flame to preheat or bring the base metal to a fusion or sweating temperature should be employed. The flame is readjusted to a slight excess of acetylene and the 459 is melted to spread over the sweated surface of the parent metal; adding additional 459 until the proper height, approximately 3/16 in., has been obtained.

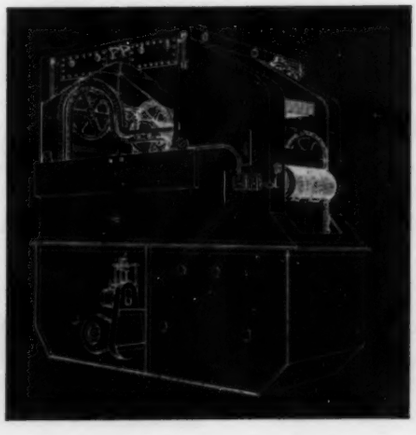
—E-46—

DEGREASING UNIT WITH ONE-DIP CONCENTRATION

▲ In addition to its present line of metal degreasing equipment, Detrex Corporation has recently introduced a new standard conveyorized one-dip concentrator to the metal cleaning industry.

Called the "1 DC-750," this degreaser is small and compact. Designed to degrease small miscellaneous screw machine parts, it is ideally suited to small shops where floor space is at a premium. The machine occupies less than 75 square feet of floor space and measures but 9 ft 9 in. in height.

The machine occupies less than 75 sq ft of floor space and measures 9 ft 9 in. in height.



The unit may be supplied with rotary or a combination of rotary and flat baskets. Rotary baskets are 10 in. diameter by 20 in. long. Work to be cleaned is loaded at one end of the degreaser, carried through the cleaning cycle, and is returned through the upper hood to the same end of the machine for unloading. The conveyor system is complete with sprockets, shafts, take-up device, speed reducer and variable speed drive. All of the sprockets below the vapor line are zinc plated as are all crossrods and conveyor chains.

—E-47—

REPUBLIC COMPLETES IMPROVEMENT PROGRAM

▲ An 11-month construction and improvement program at the Massillon plant of the Union Drawn Steel division, Republic Steel Corporation, has been completed. The program has "changed the face" of the Massillon plant to a considerable degree. Antiquated wooden buildings have been torn down and in their place modern steel and brick structures erected.

At the main Union Drawn plant in Massillon a new brick and steel structure, and bays, totalling 50,000 square feet of floor space have gone up to replace a group of wooden structures. Carbon and alloy steel bars, shapes and wire are produced at this plant.

At Union Drawn Plant No. 2, on the hill above the main plant, an extensive interior improvement program has put this entire plant into use for the production of stainless steel bars, shapes and wire — the principal uses for which are in many familiar household items, refrigerators, washing machines, etc.

In 1937 one bay of this plant was equipped for a limited production of stainless steel drawn products. Use of a second bay was added in 1940. The present improvement will put the entire 70,000 square feet of floor space of this building into this production. A considerable amount of special equipment has been acquired for the stainless steel plant.

During World War II the stainless steel plant supplied large quantities of turbine blades for naval and mer-

chant vessels at a time when submarine attacks had taken a heavy toll of existing shipping.

In the overall production of the plant the improvements will bring greater efficiency with less delays, less handling and less danger of fire. To the men who will work in them, the new facilities mean a better, safer place to work, better lighted and better ventilated.

The Massillon plant of Union Drawn is the largest producer of the six plants which make up the division. Other plants are located at Gary, Indiana, Los Angeles, California, Beaver Falls, Pennsylvania, Hartford, Connecticut, and Hamilton, Ontario. The division is the largest producer of cold drawn steel in the world with an annual capacity of 400,000 net tons per year.

Union Drawn was organized in 1889 in Beaver Falls. Its growth was steady — the Canadian plant being added in 1904 and the Gary plant in 1917.

Through a merger in 1925, plants were acquired at Hartford (formerly owned by the Frasse Steel Company); at Massillon (the former Peerless Drawn Steel Company); and another plant at Beaver Falls (formerly owned by Standard Gauge Steel Company).

The Union Drawn Steel Company became a part of Republic Steel Corporation through a merger in 1930.

The Los Angeles plant was acquired in 1946 to provide prompter service to West Coast customers.

A preview of the new, improved facilities of the plant was given 700 employees of the plant and their families.

HEAVY DUTY D-C CONTROLS FOR STEEL MILL SERVICE

▲ The industrial controller division of the Square D Company has just introduced a new line of heavy duty d-c controllers for steel mill auxiliaries, cranes and other heavy duty applications where service is severe and continuity of operation is vital. These controllers meet electrical standards developed by mill engineers to provide maximum performance under difficult conditions of application.

Contactors are available with 8 hour ratings of 100, 150, 300, and 600 amperes, and mill ratings of 133 per cent of those values. They have high

NEW EQUIPMENT BRIEFS

▲

Two-speed hydraulic jacks are available with fast speed for quick raising of light loads, and a normal speed for raising capacity loads. Raising of loads is by easy pumping action. Buda Company. NEB 20.

▲

The new portable pyrometers are recommended for use where a rugged, flexible light weight and accurate portable pyrometer is an essential requirement for quality control. This unit has been designed to permit a choice of plug-in angle extensions. Wheelco Instruments Company. NEB 21.

▲

A line of brakes designed to apply accurately controllable continuous tension in industrial machinery has been announced. These brakes are available either as self-contained units or for building into equipment under design. Linderman Devices, Inc. NEB 22.

▲

Steel can be restored to one continuous strip by arc welding and flame cutting at the same time with a new method. After the multiple torches have made their cuts in the outer edge the welder follows along making tack welds at point of entry. Air Reduction Sales Company. NEB 23.

▲

Production welders can have their health protected with more pleasant working conditions with a new fresh air, safety welding booth under development. Booth is 9½ ft wide, 9¼ ft deep and 7 ft high, and is constructed of steel fabricated panels, and can be disassembled for easy moving. Hobart Brothers Company. NEB 24.

▲

A new type of indicator constructed with the dial perpendicular to the axis of the body of the instrument has been marketed. The new dial location on the perpendicular makes the instrument very useful for general machine shop work and inspection work. Federal Products Corporation. NEB 25.

▲

Interest in the removal of dissolved oxygen, particularly from boiler feedwater, by atomization is increasing. The atomizing type of deaerator does not replace the tray type but is particularly adapted to handle corrosive and partially softened water supplies The process divides the water so finely that it provides abundant contact between the steam and water droplet surfaces making the removal of oxygen take place in a fraction of a second. Cochrane Corporation. NEB 26.

▲

Direct current moving vane type ammeters and voltmeters with exceptionally long, easy-to-read scales have just been announced. Sharply defined numerals and graduations are lithographed on warp-proof color fast metal dials which have a scale length of 80 degrees of arc on the center zero type scale and 60 degrees of arc on the zero off-center scales. U. S. Gauge Division of American Machine and Metals, Inc. NEB 27.

▲

Dust and moisture-proof, metal-housed, industrial type intercommunication staff stations for remote and privacy operation, have recently been introduced. These units are designed to solve communication problems in locations where they will be exposed to rough usage. Executone, Inc. NEB 28.

▲

An improved pulsation dampener for gauges and governors, with an estimated life of 100 years, is being produced. It is the improved "Micro-Bean" now available in all-brass and all-steel with stainless steel stem. No piston is required. Temperature has no affect on the viscosity and surface tension of liquids within the line. J. A. Campbell Company. NEB 29.

▲

A light, narrow belt grinder attachment has been developed capable of performing all kinds of light burring and grinding operations. Combining the versatility of platen grinding with the economy and speed of contact grinding it is ideal for light grinding. Especially useful in a maintenance department. Porter-Cable Machine Company. NEB 30.

▲

Recently developed is an oil operated hydraulic booster cylinder for air operated controllers. Using a standard diaphragm top it provides high power amplification and permits exact positioning of heavy dampers, valves and the like in accordance with the applied pneumatic loading pressure, usually 0-15 psi. Askania Regulator Company. NEB 31.

▲

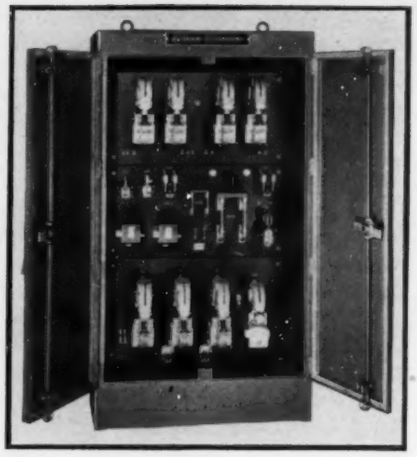
A plastics material that is made to shrink on the handles and grips of pliers, wrenches and wire cutters to serve as an electric insulator has been developed. General Electric Company, Chemical Department. NEB 32.

rupturing capacity, unusually long life and are very rapid in operation. All parts are readily accessible for inspection and maintenance. Spring closed contactors for dynamic braking are of a similar design.

Pneumatic timers that provide wide range, time limit acceleration unaffected by usual fluctuations in temperature, voltage and other conditions of application are new to the industry. They can be mechanically attached to the contactors or operated by means of a separate magnet.

Control relays are of heavy duty type, performing under-voltage, interlocking, sequencing and shunt filled control functions. Mechanical design is similar to that of contactors.

Mill type overload relay combines inverse time thermal overload protection with instantaneous trip overtorque protection in a single device. Either automatic or remote reset can be obtained by simple reconnection of shunt holding coil. Instantaneous trip setting is indicated on calibrated scale.



All parts are readily accessible for inspection and maintenance.

Double door enclosures of heavy gauge steel are available in NEMA Types I, IA or V as standard. Doors have vault type handles. Removable back plates are equipped with retained screws to save time and prevent loss.

Nonreversing controllers are available with or without dynamic braking. Reversing controllers are standard with dynamic braking, plugging, or both dynamic braking and plugging. Extra points of acceleration, armature shunt and field protective relays are optional. All controllers are suitable for use with mill type master switch and can be furnished for push-button operation.

—E-48—

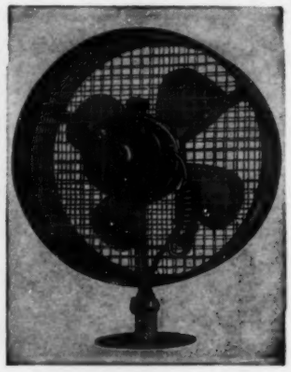
CRANE-MOUNT INDUSTRIAL TRUCKS PROVE VALUABLE

▲ Latest type of Elwell-Parker Electric Company's power industrial trucks equipped with revolving cranes are proving to be among the most useful items of mobile equipment for railroads, steel mills, metalworking plants, and others with heavy, continuous load-lifting requirements.

Engineering firms are using them for the higher-up jobs in building rolling mills for the steel industry, while in steel plants they are employed for general maintenance work.

Shops building railroad rolling stock find they are necessary for lifting

IS HEAT SLOWING UP YOUR WORKMEN?



TRUFLO CRANE CAB FANS
For cooling interiors of crane cabs and other confined areas. Adjustable both horizontally and vertically. Four blade type, 12 and 18 in. sizes.

Keep Them COOL with TRUFLO FANS

TRUFLO PORTABLE COOLING FANS
Easily portable. Help keep efficiency high where work is hottest. 12 to 36 inch diameters.

Production suffers when workmen are overheated. Steps begin to drag, efficiency falls.

Now, when speedy production is vital, Truflo Fans can help keep your workmen on their toes. All Truflo Fans are designed and built correctly to put fresh cool air *in large volumes* exactly where it is needed. Perfectly-balanced shafts and blades give more air per h.p. . . . strong steel frames stand up longer under hard use . . . rugged wire guards protect men against injuries.

All of the following types can help beat the heat, keep production moving in your plant. Write for illustrated literature.

PORTABLE COOLING FANS
CRANE CAB FANS • WALL FANS
EXHAUST FANS • BLOWERS
ROOF VENTILATING FANS
PENT HOUSE FANS

TRUFLO FAN COMPANY
554 MAIN ST., HARMONY, PA.

material and parts into place, while railroads use them in their own locomotive and car repair shops, for a wide variety of purposes. Many tons of heavy freight are transferred by means of crane trucks and other types at railroad terminals.

The cranes are capable of lifting loads weighing up to 5 tons to a height of 19 foot or more. Some types have platforms under the base of the boom, on which parts and materials may be transported to the job.

In railroad shops it frequently is necessary to shift locomotives, tenders and cars. Switch engines are not always available or desirable for this work. While crane trucks are not built to substitute for engines, nevertheless their power and construction are such that they are generally used for towing or pushing the heaviest units of rolling stock into place.

—E-50—

YOUNGSTOWN STRIP MILL IS NEARING COMPLETION

▲ Finished steel production in the Youngstown District plant of Republic Steel Corporation will be materially increased with completion late this year of a new 48-inch strip mill.

Erection of this mill is a major project in Republic's postwar expansion and improvement program for the Youngstown District.

In the past the capacity for iron and steel making of Republic's five Youngstown blast furnaces, 15 open hearth furnaces and two Bessemer converters has considerably exceeded the finishing capacity of the plant. As a result, much of the semi-finished steel has had to be shipped to other steel plants for rolling into sheets, plates, strips, bars, shapes, etc.

Whenever a decline in the demand for steel occurred, Republic in Youngstown felt this decline more seriously than plants where steel production and finishing capacities were better balanced. Orders from the other plants for semi-finished steel from Youngstown were cancelled before these mills cut back in their own steel production.

By the increase in finishing capacity, Republic workers in the by-product coke plant, the blast furnaces, the open hearth furnaces and the blooming mills will be assured of steadier future employment.

The new strip mill is being made by adding three 4-high finishing stands to the present 84-inch reversing plate mill, together with coiling and coil conveying equipment. It is expected to more than double the production of the present 84-inch mill and to produce a much greater variety of finished products. Sixty per cent of the anticipated production will be skelp for making electric weld pipe. The balance will be strip steel for further processing in Republic's Warren District.

The new strip mill will be installed in the existing 84-inch plate mill building, but will necessitate construction of three additional buildings; slab storage area, 200 by 60 feet, coil storage area, 120 by 60 feet, and a brick motor room building, 160 by 54 feet. Four heavy-duty cranes with capacities between 30 and 50 tons will be installed and one re-heating furnace will be built to supplement the three now used at the plate mill.

PEERLESS

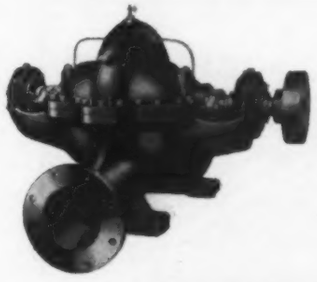
CENTRIFUGAL PUMPS

(FORMERLY DAYTON-DOWD)

FOR INDUSTRIAL USES

CAPACITIES TO 60,000 G.P.M.
A COMPLETE RANGE OF SIZES AND TYPES

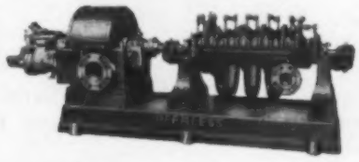
PEERLESS TYPE "A"
FOR GENERAL PURPOSE PUMPING



Split Case; Single-stage; double suction; sizes: from 8" to 42"; capacities: up to 60,000 g.p.m.

PEERLESS BOILER FEED TYPE "B" PUMP

Designed particularly for boiler feed, oil refinery and pipe line service. Pressure: to 700 lbs.; sizes: 2½", 3" and 4". Multi-stage, automatically balanced type.



PEERLESS PUMPS

Peerless Centrifugal pumps are adapted for use in a wide variety of services including municipal, paper mill, sugar mill, mining, filtration, irrigation, chemical processing, food and refrigeration uses.
Descriptive engineering bulletins available.

PEERLESS PUMP DIVISION

FOOD MACHINERY CORPORATION

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DISTRIBUTORS IN ALL PRINCIPAL CITIES

A second project of considerable importance in production at the Republic plant will be the installation of a new steam turbine high pressure blower on No. 3 blast furnace. This blower will be able to provide a blast of 90,000 cu ft per minute at 35 pounds pressure and is expected to raise the capacity of the furnace substantially. The blower is the seventh rotary-type blower to be installed and will complete modernization of the blowing equipment. Six old-fashioned vertical steam engines will be scrapped.

At the 10-inch skelp mill at Republic's Bessemer plant a new reheating furnace is being installed which will increase the capacity of that mill from an 18,000 tons per month average to about 21,500. A 36-inch edger will be installed on the 14 and 16-inch bar mills to assist in obtaining better quality products.

R. L. Leventry, district manager of the Republic Youngstown District, said that the entire program will be completed this year, providing delivery of equipment now on order is not further delayed by current industrial turmoil. He said all contracts for the work on these projects have been let and orders for all equipment placed.

TWO-TON ELECTRIC HOIST FITS MANY APPLICATIONS

▲ The Yale and Towne Manufacturing Company's line of "Midget King" electric hoists now includes a 2-ton model. Formerly the unit was available only in ⅛, ¼, ½ and 1 ton capacities. The new size hoist fits into many industrial applications where, heretofore, heavy-duty electric hoists were employed.

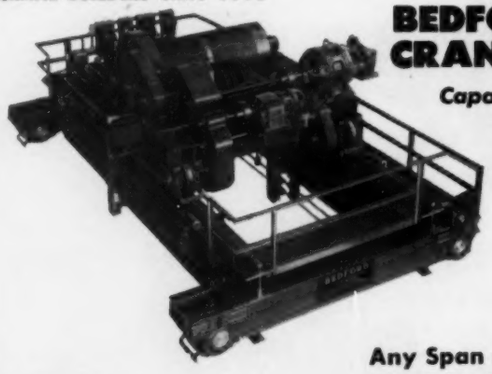
Light in weight, yet producing plenty of fast lifting power, the compact 2-ton hoist is equipped with a 1 hp motor. Lifting and lowering action is obtained by a flip of the wrist on the one-hand bar-grip control. The hoist operator thus has his other hand free to guide the load.

To carry the load, a strong, light weight alloy steel roller chain is used. The load hook is of special steel which provides maximum safety for both load and worker — opens slowly without fracture before any other part of the hoist is strained to the yield point. Upper and lower limit safety stops prevent overtravel of the hook. The load brake and independently acting motor brake operate whether the power is on or off; both brakes, all wiring, and the controller are totally enclosed.

The shaft and all gears are alloy steel, forged and hardened for maximum strength and long life. Precision bearings are used throughout. Oil bath lubrication protects all frictional parts against wear.

The 2-ton Midget King Electric Hoist is available with hook for stationary use and with a permanently attached trolley for use on an overhead track. Accessories include a chain container for collecting slack chain, eliminating kinking and keeping the chain away from the worker and the load. —E-51—

CRANE BUILDERS Since 1903



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Capacities 5 to 150 Tons

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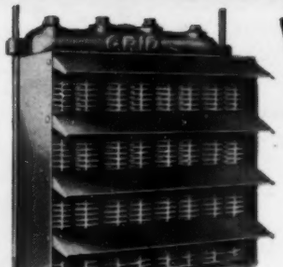
Gray Iron Castings

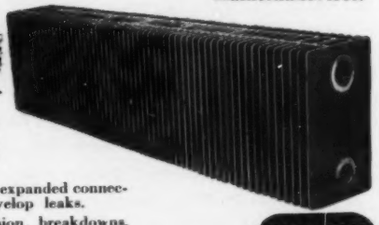
GRID UNIT HEATERS



ARE MAINTENANCE-FREE AFTER OVER 10 YEARS SEVERE SERVICE . . . . .
REPORTS A MIDWEST STEEL MILL

"Many of our GRID Unit Heaters have been in use for over 10 years and some of the units on very severe service where the steam is turned on and off several times each day, the valves being turned on and off very rapidly . . . even under this severe service we have found GRID Unit Heaters to be maintenance free."

and here's why



- One piece construction heating sections (patented) of high test cast iron that withstand steam pressures up to 250 lbs.
- No soldered, brazed, welded or expanded connections to become loose or develop leaks.
- No electrolysis to cause corrosion, breakdowns, leaks, or heating failures.

In all types of industries, GRID Unit Heaters that have been installed for as long as 15 years are still operating without maintenance cost, under all types of conditions, including corrosive atmospheres.

Complete data and capacity tables upon request.

HIGH TEST CAST IRON HEATING SECTIONS

SEND

Free booklet "Corrosion in Unit Heaters." Write for it today.

D. J. MURRAY MANUFACTURING CO.
WAUSAU, WISCONSIN

BANKED SECONDARY SYSTEM REDUCES LIGHT FLICKER

▲ Including all the advantages of "loading by copper temperature" and integral surge protection of the well known "CSP" transformers, the "CSPB" transformer just announced by Westinghouse Electric Corporation is designed especially for banked secondary operation. This transformer differs from the standard "CSP" by the addition of a secondary breaker and two extra low voltage bushings for sectionalizing faulted or overloaded secondaries.

These new transformers, when used in a banked secondary system, reduce light flicker resulting from appliance motor load, increase service reliability and reduce necessary installed capacity. The troubles previously found in banking conventional transformers such as cascading or reversion to radial operation are eliminated in the new unit by a unique arrangement of secondary circuit breakers. As in the "CSP" transformer all protective devices are incorporated with the transformer itself.

Trial installations indicate that these transformers make an economical and efficient installation adaptable to growing loads in residential areas. "CSPB" transformers are available in the 10 kva and 15 kva sizes in standard high voltage ratings from 2400 to 14,400 volts inclusive.

—E-52—

FLUORINE NOW READY FOR INDUSTRIAL USE

▲ Fluorine, the most chemically active element known, has been put on the market for the first time by the Pennsylvania Salt Manufacturing Company, it was announced recently. The element, a gas, is so active that it defied isolation for 73 years after its discovery 133 years ago and was nothing more than a laboratory curiosity until the recent war.

The element now is available in steel pressure cylinders on a limited commercial basis for experimental use by manufacturers and researchers.

Scientists foresee a whole new field of chemistry in the development of fluorine compounds — developments which may mean improvement in everyday life in everything from wonder insecticides and simplified home heating and refrigeration to insulation for electrical voltages now not possible.

Until now these potentialities have been largely theoretical because fluorine not only was difficult to produce but defied handling once it was made. The possible uses of fluorine are so great that Pennsalt officials feel that the best scientific minds of the country should be given every opportunity to develop them. It is for them — the chemists, researchers and manufacturers — that we are making compressed fluorine commercially available in limited quantities.

Of the six principal producers of fluorine chemicals to date, Pennsalt is one of the largest in tonnage output and has perhaps the longest history of fluorine development of all U. S. manufacturers. Organized in 1850, this company pioneered in this field when it was the first to import cryolite (sodium aluminum fluoride) from Greenland in 1864.

The rapidity with which fluorine combines with almost all other elements, it will burn both glass and water, has been the greatest stumbling block to its isolation and research on its use.

But the great stability of most of its known compounds is perhaps their chief value. Although fluorine is the most chemically active element known, when it combines with other elements the resulting compounds become very stable.

Freons, widely used as refrigerants since 1930 and as the propellant for insecticides in the "bug bombs" used by the thousands during the war, demonstrated this. They were made practical after Pennsalt sent out the first tank car ever shipped of anhydrous hydrofluoric acid. Dyes made from fluorine compounds have special brilliance and color fastness. It is said that the red dye used in official Nazi flags was made from such a compound.

Now scientists foresee hundreds of uses for fluorine that may become possible with the availability of it in its elemental form. Some outstanding ones are:

A non-inflammable, non-toxic liquid with a high enough boiling point and specific gravity that it can replace mercury in the present mercury vapor boiler, making the most efficient vapor engine practical and safe.

A gas, already developed but requiring elemental fluorine to manufacture, which is a nearly perfect insulator for high voltages used in x-ray and nuclear physics.

A lubricating oil so stable that it will not oxidize or break down under any present engine or mechanical operations and will make possible gears and engines heretofore only dreamed of by designers because no lubricant made could withstand their pressure and friction.

—E-53—

SHOCK TEST LABORATORY FOR INDUSTRIAL PRODUCTS

▲ Improved testing and laboratory facilities for a variety of its industrial and marine products have been announced in recent months by Allis-Chalmers Manufacturing Company. Among these are a new "shock-test" laboratory developed in cooperation with the Navy during the war, a new electronic processing laboratory and a new steam turbine auxiliary test floor.

The "shock-test" laboratory is available to the company's engineering staffs for testing materials and devices likely to be subjected to extremely harsh treatment in service. It is equipped to handle high-impact shock, vibrating, humidity and temperature, salt spray, and electrical and mechanical life tests. The shock tests consist of subjecting the product to different mounting positions in a special high impact shock machine capable of handling devices up to 4500 lb and having a shock blow capacity of 18,000 ft-lb. By giving the shock in various directions, subsequent visual inspection and operating devices provide positive evidence of the strength of the product being tested.

The new electronic processing laboratory in Allis-Chalmers' electric control plant is devoted exclusively to the analysis and processing of samples and the design of proper coils for production work for present and prospective users of induction heating equipment. Equipped with standard heating units, the laboratory also provides improved facilities for those wishing to visit the plant to observe tests on their own products.

—E-54—

New Members

Active

Thomas E. Barton
Design Engineer
Carnegie-Illinois Steel Corporation
Youngstown, Ohio

Joseph Bicsak, Jr.
Engineering Department (Draftsman)
Great Lakes Steel Corporation
Ecorse, Detroit, Michigan

Robert G. Bryan
Fuel Engineer — Gary Works
Carnegie-Illinois Steel Corporation
Gary, Indiana

George A. Butler
Electrical Engineer
National Tube Company
Lorain, Ohio

Ernest E. Davis
Assistant Superintendent of Rolling Mills
Carpenter Steel Company
Reading, Pennsylvania

T. C. Dawson
Shop Supervisor — Electrical
Bethlehem Steel Company
Bethlehem, Pennsylvania

Karl Gustaf Ingemar Follin
Vice President
AB Svenska Metallverken
Vasteras, Sweden

Albert H. Highley
Superintendent Roll Shop (Roll Designer)
Carpenter Steel Company
Reading, Pennsylvania

James A. Holmes
General Foreman
Great Lakes Steel Corporation
Ecorse, Detroit, Michigan

Frank Janecek
Blast Furnace Engineer
Republic Steel Corporation
Cleveland, Ohio

Dr. Ing. Jaroslav Jicinsky
Assistant Director General
Czechoslovak National Steel Corporation
Praha, Czechoslovakia

James R. Lamberton
Electrical Engineer
Project Engineering
National Tube Company
Lorain, Ohio

Samuel Naismith
Blast Furnace Design Engineer
C. D. C. B.
Carnegie-Illinois Steel Corporation
Chicago, Illinois

Dr. George Riegl
Consulting Engineer
Czechoslovak National Steel Corporation
Prague, Czechoslovakia

Frederick H. Rowe, Jr.
General Foreman
Great Lakes Steel Corporation
Ecorse, Detroit, Michigan

Ronald C. Stott
Assistant Works Electrical Engineer
Messrs. Guest Keen Baldwins,
Iron and Steel Company, Ltd.
Port Talbot, South Wales, Great Britain

W. M. Service
Special Director and Works Manager
Wm. Beardmore & Company, Ltd.
Parkhead Steel Works
Glasgow, Scotland

Curtis Fleming Seyler
Assistant Chief Engineer of Plants
Jones & Laughlin Steel Corporation
Pittsburgh, Pennsylvania

Myron E. Strate
Assistant to Superintendent of Maint. Shops
Carnegie-Illinois Steel Corporation
Youngstown, Ohio

George W. Thomas
Time Study
Inland Steel Company
East Chicago, Indiana

R. L. Willmott (Col.)
Chief Engineer (Maintenance)
John Summers & Sons, Ltd.
Shotton, near Chester, England

Herbert W. Barr
Purchasing Department
Tennessee Coal, Iron and Railroad Company
Birmingham, Alabama

A. S. Chalfant
Industrial Engineer
Carnegie-Illinois Steel Corporation
Pittsburgh, Pennsylvania

Walter Richardson Huxley
Turn Foreman — Cold Strip Mill
John Summers & Sons, Ltd.
Hawarden Bridge, Nr. Chester, England

William H. Hyde
Supervising Engineer — Methods Planning
Tennessee Coal, Iron and Railroad Company
Birmingham, Alabama

Albert Thorpe Ledgard
Assistant Blast Furnace Manager
Dorman Long & Company, Ltd.
Middlesbrough, Yorkshire, England

James Meranda
Electrical Engineer
Bethlehem Steel Company
Lackawanna, New York

Robert H. Meyer
General Plant Foreman — Coke Ovens
Bethlehem Steel Company
Lackawanna, New York

William F. Nagel, Jr.
Assistant Chief Metallurgist and Inspector
Carnegie-Illinois Steel Corporation
Irvin Works
Dravosburg, Pennsylvania

P. H. Ohmer
Special Engineer — Conditioning Department
Carnegie-Illinois Steel Corporation
Duquesne, Pennsylvania

John C. Peth
Electrical Engineer
Pittsburgh Steel Company
Monessen, Pennsylvania

Wendell R. Tate
Fuel Engineer
Blast Furnace Division
Great Lakes Steel Corporation
Ecorse, Detroit, Michigan

Clayton Van Boxel
Gas Engineer
Great Lakes Steel Corporation
Ecorse, Detroit, Michigan

D. G. Willmot
Assistant to General Manager
Atlas Steels, Limited
Welland, Ontario, Canada

Charles Forrest Bailey
Chief Steel Plant and Furnace Engineer
The American Rolling Mill Company
Middletown, Ohio

Graham B. Brown
Tube Mill Development Engineer
Youngstown Sheet & Tube Company
Youngstown, Ohio

John P. Coogan
Design Engineer
Carnegie-Illinois Steel Corporation
Munhall, Pennsylvania

Robert S. Deans
Project Engineer — Irvin Works
Carnegie-Illinois Steel Corporation
Dravosburg, Pennsylvania

James Douglas
Draftsman in Charge Strip Mill Design
Steel Company of Canada, Limited
Hamilton, Ontario, Canada

Donald M. Drum
Assistant Roll Designer
Inland Steel Company
East Chicago, Indiana

John Hugh Fraser
General Superintendent
Dominion Steel & Coal Corporation, Ltd.
Sydney, Nova Scotia, Canada

John W. Gehring
Assistant Project Engineer — Irvin Works
Carnegie-Illinois Steel Corporation
Dravosburg, Pennsylvania

Robert Gourlay
Assistant Roll Designer
Algoma Steel Corporation, Ltd.
Sault Ste. Marie, Ontario, Canada

Paul E. Johnson
Specification Engineer
Carnegie-Illinois Steel Corporation
Gary, Indiana

Lloyd F. Loftus
Engineer
National Tube Company
Lorain, Ohio

Frank C. McGough
Combustion Engineer
A. M. Byers Company
Ambridge, Pennsylvania

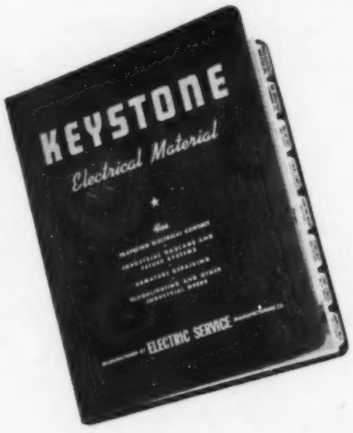
Harry V. Miller
General Foreman Power Department
American Rolling Mill Company
Middletown, Ohio

Harry H. Northrup
Assistant Superintendent Open Hearth
Republic Steel Corporation
Buffalo, New York

William J. O'Brien
Instrument Supervisor
A. M. Byers Company
Ambridge, Pennsylvania

KEYSTONE

Crane Contact Rail Insulators



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Keystone Crane Contact Rail Insulators provide reliable service for the Carnegie-Illinois Steel Corp. (Homestead Works). Here they are shown in connection with the Morgan Charging Crane at open hearth.

Keystone Contact Rail Material provides the constant contact that insures reliable transmission of power to your cranes, conveyors and other electrical industrial hoisting and hauling systems.

A complete line utilizing either rails, angles, bars or wire as conductors and including numerous types of insulators for either under-running or over-running operation. You may also select from many types of current collectors including Junior, Universal and Pantagraph styles and contact rail shoes.

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Area to absorb heat of motor starting current and short heavy surges.

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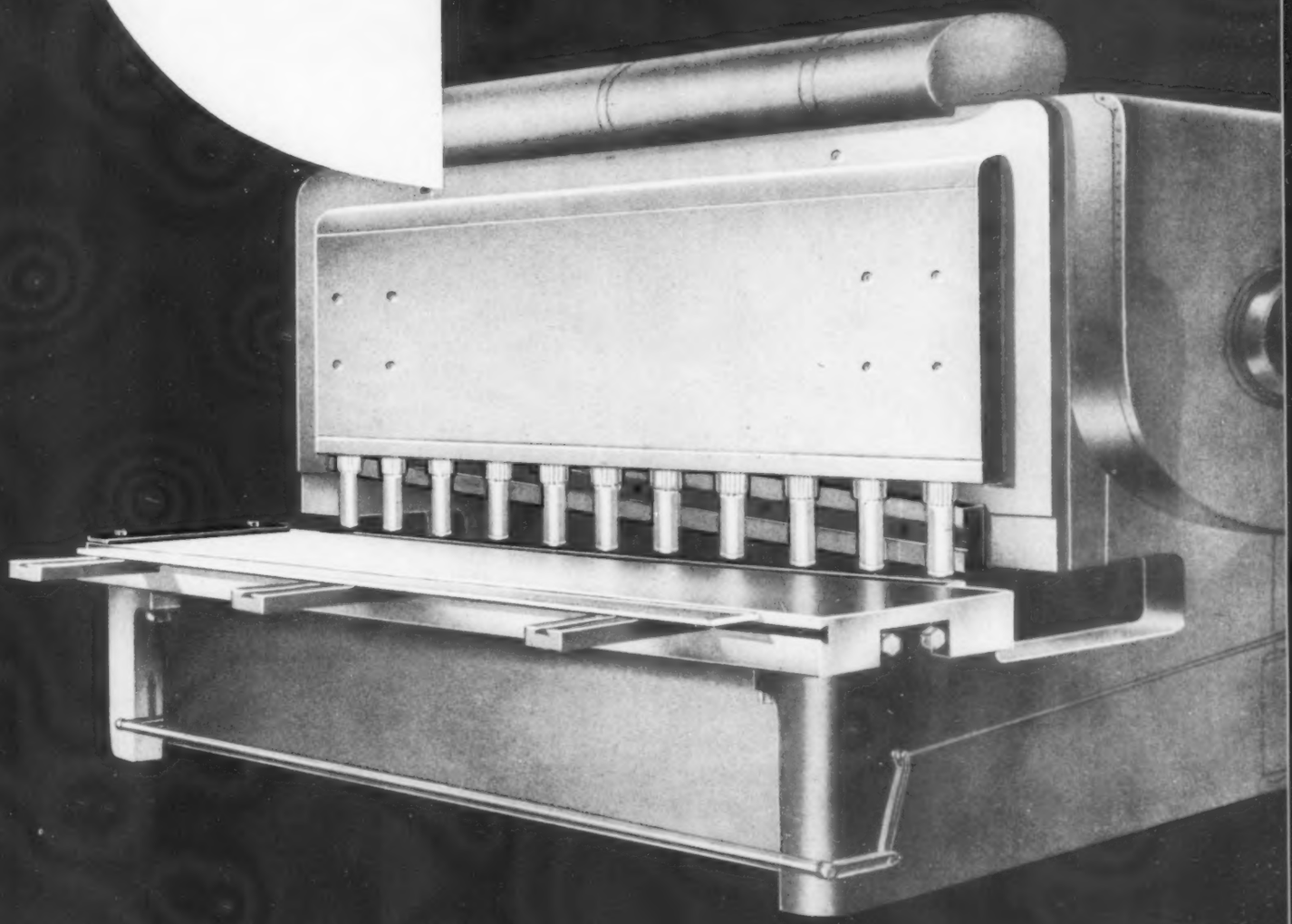

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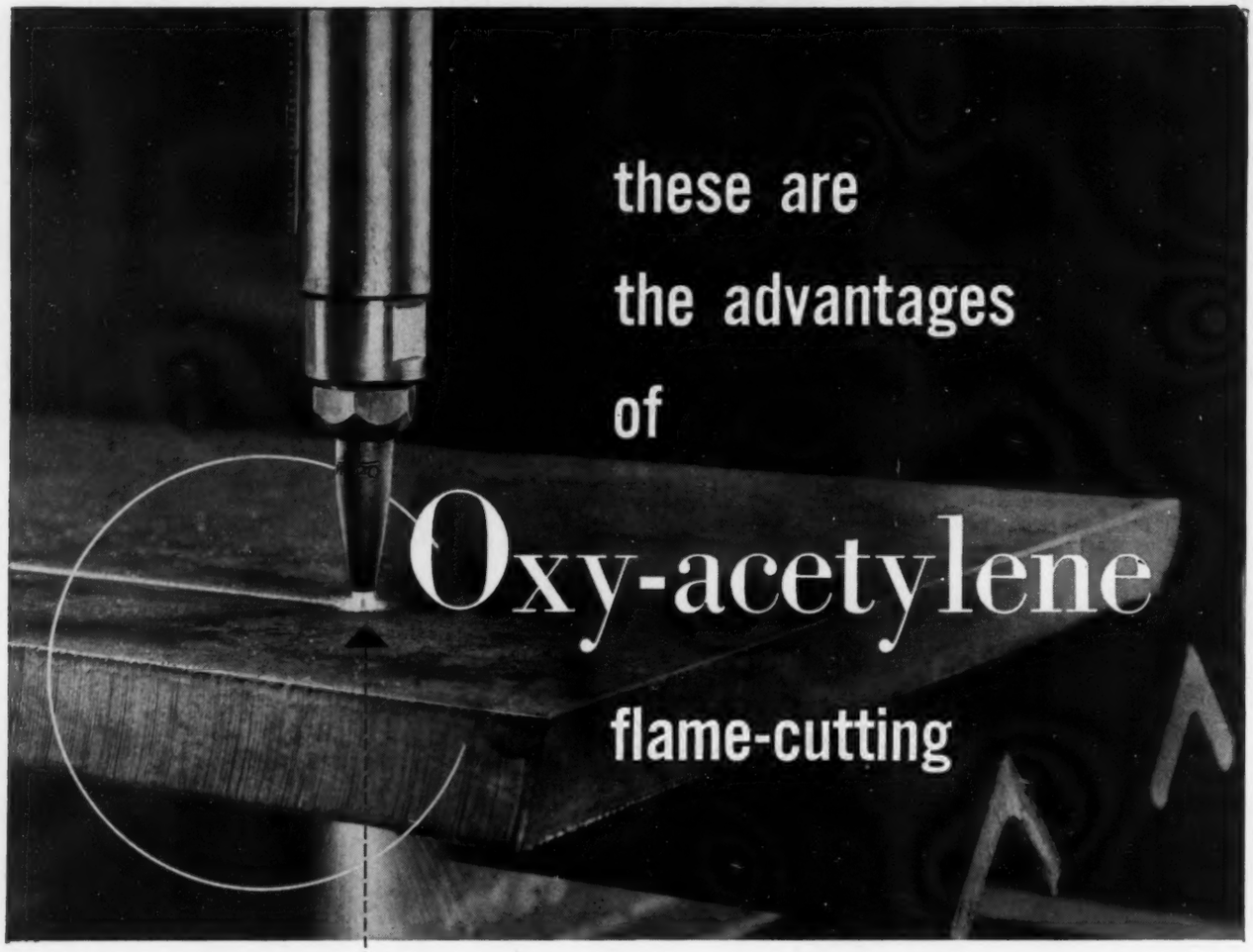

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A.I.S.E.

1946 ANNUAL CONVENTION and IRON AND STEEL EXPOSITION

PUBLIC AUDITORIUM, CLEVELAND, OHIO

October 1, 2, 3, and 4, 1946

It is with considerable pleasure that the Association of Iron and Steel Engineers again invites the men of the steel industry to the 1946 Annual Convention and Iron and Steel Exposition.

Bigger and better than ever before, the Exposition — the first since 1941 — will be bristling with the many developments of the past five years. The technical sessions have also been greatly amplified.

The Association is proud to offer this four-day program. Plan to come to Cleveland, to see, hear and take home ideas that will benefit you and your company.

Freeman H. Dyke

President
Association of Iron and Steel Engineers

Program .... CLEVELAND PUBLIC AUDITORIUM

Tuesday, October 1

Iron and Steel Exposition — 10:00 a.m.-10:00 p.m — Arena and Exhibition Hall

9:00 a.m. — REGISTRATION — Main Lobby

9:00 a.m. — LADIES REGISTRATION — Parlor M, Hotel Statler

9:15 a.m. — BUSINESS MEETING — Ball Room

Conducted by President F. H. Dyke

9:30 a.m. — ELECTRICAL SESSION — Ball Room

Chairmen:
F. W. Cramer, Carnegie-Illinois Steel Corporation
V. E. Schlossberg, Inland Steel Company

"Gearing for Steel Mill Auxiliaries and Cranes," by L. J. Collins, General Electric Company.

Discussion of Mill Type Motor Ratings, by Frank Cramer, Carnegie-Illinois Steel Corporation.

Standardization Committee Reports, by chairmen of various sub-committees.

2:00 p.m. — OPERATING PRACTICE SESSION — Ball Room

Chairmen:
C. L. McGranahan, Jones & Laughlin Steel Corporation
J. L. Tatman, Wheeling Steel Corporation

"Scale Removal and Surface Preparation by Reduction with Sodium Hydride," by H. L. Alexander, E. I. du Pont de Nemours & Company.

"Roller Leveling and Processing of Flat Rolled Products," by A. J. Wardle, Jr., McKay Machine Company.

"The Corrugating of Sheet Metal," by Joseph E. Kiefer, The Streine Tool and Manufacturing Company.

2:00 p.m. — COMBUSTION SESSION — Club Room B

Chairmen:
P. F. Kinyoun, Bethlehem Steel Company
E. C. Hite, Timken Roller Bearing Company

"Heating and Melting Furnace Controls," by C. G. Bigelow, Jr., Loftus Engineering Corporation.

"Economics of High Pressure Steam for Steel Plant Power," by F. A. Sawyer, Stone and Webster Engineering Corporation.

"Heat Problems in the Steel Industry," by Victor Paschkis, Columbia University.

10:00 p.m. — Exhibitors' Dance, Euclid Ball Room, Hotel Statler

Wednesday, October 2

Iron and Steel Exposition — 10:00 a.m.-10:00 p.m.

9:00 a.m. — SAFETY SESSION — Ball Room

Chairmen:
R. H. Ferguson, Republic Steel Corporation
James Farrington, Wheeling Steel Corporation

Safety Symposium

"Industrial Health Problems in the Steel Industry," by J. William Fehnel, Metropolitan Life Insurance Company.

"Recommended Practice in Connection with Fire Prevention and Safety in By-Product and Benzol Plants," by R. W. Schirmer, Hendricks Engineering Corporation.

"Suggested Methods Which May Be Used to Prevent Accidents from Asphyxiation and Explosions of Various Types of Gases," by J. M. Lewis, Mine Safety Appliance Company.

12:15 p.m. — Old Timers' Luncheon, Euclid Ball Room, Hotel Statler

2:00 p.m. — ELECTRICAL SESSION — Ball Room

Chairmen:
E. L. Anderson, Bethlehem Steel Company
M. B. Antrim, Lukens Steel Company

"Latest Trends in Commutation," by Leon D. Cook, Commonwealth Edison Company.

"Comparison of A-c and D-c Power Distribution," by G. A. Kaufman, Jones and Laughlin Steel Corporation.

"Spot Conversion for Adjustable Speed Drives," by R. A. Geuder and W. R. Hough, Reliance Electric and Engineering Company.

2:00 p.m. — COMBUSTION SESSION — Club Room B

Chairmen:
C. J. Wyrough, Jones & Laughlin Steel Corporation
H. S. Hall, Lukens Steel Company

"Submerged Combustion in Industry," by W. G. See, Submerged Combustion Company of America.

"Recent Improvements in Cover Annealing," by A. J. Fisher, Bethlehem Steel Company.

"A New Method of Strip Coil Annealing," by H. H. Armstrong and F. F. Schlitt, Lee Wilson Engineering Company, Inc.

Thursday, October 3

Iron and Steel Exposition — 10:00 a.m.-5:30 p.m.

9:00 a.m. — ELECTRICAL SESSION — Ball Room

Chairmen:
I. N. Tull, Republic Steel Corporation
A. D. Howry, Alan Wood Steel Company

"Electrical Equipment for the Sendzimir Cold Strip Mill," by H. W. Poole, General Electric Company.

"Schemes and Methods for the Control of Plugging," by E. J. Posselt, Cutler-Hammer, Inc.

"Power and Power Factor in Arc Furnace Operation," by Earle H. Browning, Westinghouse Electric Corporation.

9:00 a.m. — LUBRICATION SESSION — Club Room B

Chairmen:
C. E. Pritchard, Republic Steel Corporation
C. R. Hand, Bethlehem Steel Company

"Surface Activity of Lubricants," by J. M. Wilson, Shell Oil Company, Inc.

"Analysis of Centralized Lubricating Systems," by J. P. Gravenstreter, Carnegie-Illinois Steel Corporation.

"Rust Preventive Compounds," by H. Carpenter, Standard Oil Company of New Jersey.

2:00 p.m. — MECHANICAL SESSION — Ball Room

Chairmen:
L. J. Gould, Bethlehem Steel Company
T. R. Moxley, Wheeling Steel Corporation

"Automatic Welding in Steel Plant Maintenance," by H. E. Holman, Jones and Laughlin Steel Corporation.

"Storage Yard Material Handling," by Frank C. Wier, The Timken Roller Bearing Company.

"Scheduling of Maintenance Shops," by L. E. Fuller, Jr., Carnegie-Illinois Steel Corporation.

2:00 p.m. — COMBUSTION SESSION — Club Room B

Chairmen:
E. C. McDonald, Republic Steel Corporation
B. B. Bargman, Carnegie-Illinois Steel Corporation

"Improved Design of Metallic Recuperator," by Frank D. Hazen, Hazen Engineering Company.

"Relation of Refractory Economy to Combustion in Steel Mill Furnaces," by Edwin N. Hower, Carnegie-Illinois Steel Corporation.

"Heating Rate Tests of Slab Reheating Furnaces," by J. W. Percy, United States Steel Corporation.

7:30 p.m. — Formal Dinner-Dance, Grand Ball Room, Hotel Statler

Friday, October 4

Iron and Steel Exposition — 10:00 a.m.-4:00 p.m.

9:00 a.m. — OPERATING PRACTICE SESSION — Ball Room

Chairmen:
W. H. Collison, Great Lakes Steel Corporation
J. B. Hill, Bethlehem Steel Company

"Iron Ore Reserves of the Mesabi Range," by E. W. Davis, University of Minnesota.

"The Chemical Removal of Scale, Sludges and Oxides from Blast Furnace and Allied Steel Mill Equipment," by B. H. McDaniel, Dowell, Inc.

"The Manufacture of Oxygen in Large Quantities for Industrial Uses," by Martin J. Conway, Consulting Engineer.

2:00 p.m. — ROLLING MILL SESSION — Ball Room

Chairmen:
Alex Montgomery, Jr., Carnegie-Illinois Steel Corporation
Louis Moses, Bethlehem Steel Company

"Modern Seamless Tube Mills," by William Rodder, The Aetna-Standard Engineering Company.

"The Use of Tension in Sizing Small Diameter Seamless Pipe and Tubing," by S. W. Stouffer, National Tube Company.

"Rod Mills and Rod Mill Roll Design," by Ross E. Beynon, Carnegie-Illinois Steel Corporation.

2:00 p.m. — LUBRICATION SESSION — Club Room B

Chairmen:
D. N. Evans, Inland Steel Company
R. A. Barta, Republic Steel Corporation

Symposium on Soluble Oils:

"Quenching and Processing," by Steven Smith, Air Reduction Sales Company.

"Cold Reduction of Strip," by J. R. Powell, Jones and Laughlin Steel Corporation, and R. W. Piper, Apex Alkali Products Company.

"Cutting and Grinding," by C. M. Larson, Sinclair Refining Company.

"Bacterial Deterioration," by L. Liberthson, L. Sonneborn Sons, Inc.

All of the events of the Convention and Exposition, with the exception of the social functions, will be held in the Cleveland Public Auditorium.

Iron & Steel Exposition

SPONSORED BY

ASSOCIATION OF IRON AND STEEL ENGINEERS

PUBLIC AUDITORIUM, CLEVELAND, OHIO

OCTOBER 1, 2, 3, and 4, 1946

The annual Iron and Steel Exposition which will be held in conjunction with the Annual Convention of this Society promises to be of considerable interest to all the steel mill executives and operating men. Approximately 150 manufacturers of steel mill equipment will utilize 30,000 square feet of space in the exhibit halls to display their latest designs of equipment. This year's Iron and Steel Exposition is the first to be held since the beginning of World War II. During the war years and the current reconversion period there have been rapid strides in the developments of new methods and new products. At the Exposition you will see for the first time all of the developments as they pertain to the iron and steel industry. Never before has it been so important to keep abreast of new developments. From advance information it can be truthfully said that this coming Iron and Steel Exposition will be one which few steel men can afford to miss.

EXPOSITION HOURS

Tuesday, October 1	. . . .	**10:00 A.M. to 10:00 P.M.**
Wednesday, Oct. 2	. . . .	**10:00 A.M. to 10:00 P.M.**
Thursday, Oct. 3	. . . .	**10:00 A.M. to 5:30 P.M.**
Friday, Oct. 4	. . . .	**10:00 A.M. to 4:00 P.M.**

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FOR THOSE WHO MUST *KNOW*

(1) Secondary Banking

How transformers can overcome disadvantages of conventional banked secondary systems for improved service and reduced cost is explained in a new booklet that is available to you. This book diagrams radial, network and conventional banking systems, as well as the new banked secondary method for obtaining protection with a completely self-protected transformer, which contains a circuit breaker in addition to the one required for thermal protection. (B-3777). Westinghouse Electric Corporation.

(2) Temperature Characteristics . . . .

. . . . of electrical insulation is the title of a technical publication that is available to you. Since the first "Megger" insulation tester was used in this country, in 1910, engineers have known that electrical insulation resistance is affected by temperature. What has not been so well known is how much, and how formulas and coefficients could be determined. This bulletin attempts to summarize and to discuss some of the published and available unpublished information on this important but rather difficult subject. (21-T4). James G. Biddle Company.

(3) Hardening Methods

Hardening in standard rated furnaces is described in a bulletin just issued. The bulletin gives a brief resume of hardening practices and shows a photo micrograph of steel in the spheroidized and in the hardened state. Ideal types of furnaces for various methods of hardening are shown together with illustrations of hardened steel parts and actual furnace installations. These include oven, pot, and atmosphere hardening furnaces as well as isothermal quench furnaces. (SC131). Surface Combustion Corporation.

(4) Steel Grid Resistors

A new catalog describing steel grid resistors is available to you. The book describes the Type T2 resistors, which are made from a special rolled steel containing 14 per cent chromium. They are unbreakable and are highly corrosion resistant. This type of resistor was designed for use in steel mills and other applications where electrical equipment is subjected to severe treatment. Complete data on this phase of electrical equipment is included. (500). Post-Glover Electric Company.

(5) Electric Hoists

Replete with pictures and technical data a new catalog has been published on the "Midget King" electric hoists. The catalog gives diagrams and sketches showing how the hoist speeds operate on d-c and a-c circuits. Capacities of the hoists are $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1 and 2 tons. (P-577). Yale and Towne Manufacturing Company.

(6) Continuous Blowoff

A two-part article entitled: "Continuous Blowoff for Boiler Plants" has been reprinted and is available for those interested in the saving possible with heat recovery from boiler blowoff waters. The articles include a thorough discussion of concentration of solids in boiler water, the calculation of dollar-savings estimates, and the added value of flash steam recovery over heat exchangers. (Repr 45). Cochrane Corporation.

(7) Pocket Catalog

"Ventilation for the Nation" is the title of a pocket catalog on industrial ventilation that is available to you. Complete technical data on the usage of blowers and fans is included in the 52 page book, including pictures, diagrams, and tables. (543). Ilg Electric Ventilating Company.

(8) Retaining Rings

A catalog that highlights new developments in retaining rings used to lock and position moving parts such as shafts, gears bushings, and bearings is offered to you. The catalog describes the rings that represent a radical departure from conventional rings. Engineering data on various applications of retaining rings is included. Waldes Koh-I-noor, Inc.

(9) Industrial Gas Masks

Industrial gas masks for protecting workers against various gases, smokes, vapors, and dusts, are described in a pamphlet available to you. The masks are designed to safeguard wearers without hampering normal operations. Chemicals of suitable composition to give respiratory protection against some 75 gases are contained in canisters and connected to the mask in each case by means of a flexible tube. Some of the masks have been approved by the Bureau of Mines. They do not offer protection against carbon monoxide or gases containing it, such as illuminating gas. (EDII). Mine Safety Appliances Company.

(10) Engine Generators

A series of eight specification sheets on engine generators are available for your looseleaf ready reference file book on this subject. All of these engine generators are compact, economical, and long-lived producing desired kw intermittently, carrying desired kw safely for two hours, or a specified amount continuously. (Spec. Sheets 204-207; 209-212). Ready Power Company.

(11) Buyers' Guide

Designed to be of genuine help to the processor in all fields is a new bulletin "Buying Guide for Process Industries" which is available to you. The book features a series of thumbnail buying guides aimed at helping the reader in making the preliminary selection of any of a complete range of industrial products. The book for example tells you how to first determine the mechanical and electrical motor characteristics required for your job. Figure what speed and hp ratings are needed . . . what torque requirements. Next decide if you will need open, enclosed, or splashproof construction . . . or an explosionproof motor. Then select the motor that will best fit your needs. (25B6177B). Allis-Chalmers Manufacturing Company.

(12) Electrode Wall Chart

A graphic, four-color, 25 in. by 40 in. electrode selection chart has been published and is available to you. The chart assists operators in the choice of the correct electrode for a particular job. The chart specifies which electrodes to use, shows currents, gives mechanical properties, and also includes an electrode color guide which shows the electrodes in their actual colors. Air Reduction Sales Company.

(13) Steam Jet Agitators

A folder is available describing steam jet agitators for heating and agitating pickling baths and chemical solutions. The folder indexes the jets available, and gives data on the selection of steam jets, and tells why this company's jets have proven to be successful. Also included is information on a complete series of jets for the direct introduction of steam or air into corrosive solutions to heat them to the optimum temperatures. (43). Heil Engineering Company.

(14) Shearing . . . .

. . . . Flat Rolled Steel" is the title of a reprint of an article that appeared in the IRON AND STEEL ENGINEER that is available to you. The article is a compendium on the problems encountered in the shearing of flat rolled steel. There had been, prior to the publication of this article, very little practical data available on the subject. The cooperation of one of the outstanding steel companies with a shear making engineer made it possible to secure test results and compile data of value to everyone concerned with shearing. (34 pages) Wean Engineering Company Inc.

(15) Selector charts

There is available to you a quick-finding selector chart which will show you your exact coupling requirements at a glance, without tedious figuring. The chart gives complete data, weights and prices. Every mechanical and electrical department engineer or executive should have one of these charts for ready reference. Lovejoy Flexible Coupling Company.

(16) Control Relays

A catalog is available to you on alternating and direct current relays which consist of small, solenoid operated switching units for industrial applications that require compact miniature contactors of unfailing dependability. The catalog includes sizes, prices, type numbers and diagrams of each type of relay available. (700). Allen-Bradley Company.

(17) Precision Bearings

"Precision type radial and thrust cylindrical roller bearings" is the name of a catalog that is available to you. The book contains bearing selection and engineering information, dimensions and load rating tables of sizes in single and double width radial types, aligning single and double width radial types, single acting, double acting, aligning and crane hook thrust bearings. (241-RT). Rollway Bearing Company.

(18) Resistance Welding

A bulletin designed for welding and maintenance men is available. The bulletin should assist in the selection of proper resistance welding equipment for specific

production jobs. Illustrations, photographs, charts, engineering data and descriptions are included. The welders described are of the spot type and are foot operated, air operated, and motor operated. (W-2-413). Taylor-Winfield Corporation.

(19) Counting . . . .

. . . . these days means exact knowledge of just how much work a machine is doing so that your costs can be kept in line. There are available for you two booklets on units that are designed to count and total practically anything that moves. You can count items, strokes, revolutions, and practically anything else you can think of with these units. The subject of counting in relation to costs is infinite. (50 and Shadowcount). Autotron Company and Production Instrument Company.

(20) Analysis Guide

"Materials handling Analysis Guide" is the title of a booklet that is available to you. The booklet, which is pocket-size, tells why materials handling is an indispensable factor in any factory, warehouse or terminal operation. It begins with the raw material, continues on through processing and production to storage and even to the final delivery of the finished product to its destination. Towmotor Corporation.

(21) Centrifugal Pumps

A catalog on two-stage centrifugal pumps is available to you describing the industrial uses of these pumps. These pumps, according to the book, are used as condensate service for power plants and general use throughout steel mills. The pumps described are two-stage, ball-bearing units designed to operate at modern motor, turbine and engine speeds. Available capacities are up to 2200 gpm for discharge heads up to 1050 ft (450 lb per sq in.). Catalog contains cutaway views, types of drives, typical installations, and tables of performance, dimensions and pipe friction, and a typical pumping problem is worked out in detail. (7062). Ingersoll-Rand Company.

(22) Steel Production

"The Ingot Phase of Steel Production" is the title of a book that is limited to supervisory personnel engaged in steel production. This is a revised edition of a book printed in 1937 and 1938 covering that period embracing the operations involved from the finishing of the heat, through teeming, solidification and reheating of the ingot to the initial working in the mill. The Gathmann Engineering Company.

(23) Space Heating

Now is the time to think of next winter's heating problem, and a booklet is available to assist you in your thinking along these lines. The booklet, entitled: "Direct-Fired Efficiency," explains the high efficiency of direct-fired warm air heating, and tells how this economical heater is especially adapted for providing a simple and logical method for heating buildings with large, unobstructed areas. Their simplicity is reflected in low installation and operating costs. (514). Dravo Corporation.

(24) Recuperators

"Recuperators for the Steel Industry" is the title of a new publication that is available to you. The publication describes the use of silicon carbide super refractory heat transfer tubular elements in all recuperator applications to furnaces operating at high temperatures. Cutaway views, 36 diagrammatic views of applications, several curves showing fuel savings and low leakage values, plus detailed descriptions are included in this excellently prepared book. Fitch Recuperator Company.

(25) D-C Arc Welders

Details on this company's line of motor or belt-driven arc welders for direct current use are described in a catalog that should be in the maintenance man's looseleaf file. The catalog does not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. The catalog discusses: installation, operation, maintenance, overhaul information, renewal parts, trouble-shooting, and parts and price list. (GEH1334). General Electric Company

(26) Endbells and Housings

A bulletin is available presenting a line of replacement endbells and housings, with which sleeve bearing electric motors and pumps are converted to ball or roller bearing operation, with a minimum of trouble and expense. The bulletin describes the great demand for this equipment in steel mills where dust and dirt produce rapid wear of sleeve bearings, and where, because of the type of operation, the ball bearing motor is more reliable. Keystone Electric Company.

(27) Steel Mill Equipment

A catalog on special equipment for blast furnaces and steel mills is available. The book describes the auto floor charging machine; auto floor manipulator; overhead charger; goggle valve; electrical mechanical clay gun; electro-hydraulic clay gun; single hook grab bucket; automatic single hoist grab bucket; electro-hydraulic bucket; motor driven slag bucket; automatic dump bucket; dry slag granulating mill; and soaking pit cover carriage. Each of the foregoing items is completely described including application photographs and diagrams. Edgar E. Brosius Company.

(28) Carbon products

"Carbon Products in the Steel Plant" is the title of a reprint of an article, which appeared in the May issue of the IRON AND STEEL ENGINEER. This article, which is available to you, covers the use of carbon instead of ceramic linings in blast furnaces and other steel mill applications. Some recent applications are also included. The paper presents a comprehensive idea of the many ways in which carbon and graphite are used in the iron and steel industry. National Carbon Company, Inc.

(29) Non-Metallic Bearings

A bulletin describing non-metallic bearings, the laminated resin textile product that has proved so successful for roll necks and other bearing positions in steel mill service, is now available. These bearings, which have been in use for many years and which have established enviable performance records in rolling mills throughout the country, are especially designed for water lubrication. Case studies presented in the bulletin point to power savings running as high as 35 per cent Joseph T. Ryerson and Son, Inc.

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FOR THOSE WHO MUST *KNOW*

Products and Developments

(30) Ironclad Batteries

Modern materials handling requires electric industrial trucks powered by good batteries. There is a bulletin available telling about the use of ironclad batteries for electric industrial trucks, and the power ability with sustained high voltage and high electrical efficiency. Features of construction are shown and discussed with useful tables giving data on the ironclad battery. (208). Electric Storage Battery Company.

(31) Revolving Heaters

The modern system of industrial plant heating is discussed in a catalog on revolving unit heaters, which were developed after many years' experience with the highly efficient featherweight unit heater with fixed discharge outlets. Included in the bulletin are design and construction; engineering data; mounting heights and coverage; dimensions and weights; typical specifications; wiring details; installation planning; and piping details. Cutaway views and sketches showing details are included. (HR-4). L. J. Wing Manufacturing Company.

(32) Lubricant Film

"Lubriplate" was developed to meet the requirements of modern industry and to effect economy as well as improvement in machine operation. How this is done is told in a new bulletin available to you. The catalog tells how the lubrication of old machinery can be solved by the use of this new lubricant. Many old machines that might otherwise be discarded have been found to operate with new efficiency with this remarkable lubricant. Bearings will last longer, according to the bulletin, and the machine can speed up beyond original rates. Lubriplate Division, Fiske Brothers Refining Company.

(33) Cement Guns

A catalog is available which will tell you how to rebuild stacks, building walls, masonry, and other types of construction with a cement gun. Described is the "gunite" cement which can be used for rebuilding old, unsafe, steel stacks into self-supporting stacks; for rehabilitating old concrete and brick stacks; and for the lining of new or old steel stacks. It can be used, according to this catalog, for placing refractory materials for maintaining surfaces subjected to high temperatures. In one steel plant, a score of machines are variously located permanently, so that trained crews have the necessary equipment available when arriving to make repairs. (2300). Cement Gun Company.

(34) Mechanical Chipping

Dedicated to executives who are concerned with steel production and costs, an attractively prepared publication is waiting your encirclement of the proper number below. The book asks the question whether you are still chipping billets by hand, while your competitors are using two, three, four and five "Billeteers," and tells you how one large steel company is now operating nine of these time-saving machines. The book claims that hand chipping is outdated, and cannot compete with the low tool costs, low power costs, low overall chipping costs obtained with this unit. Bonnot Company.

(35) Lighting Switch

Every once in awhile something really and truly new comes along. There is available a bulletin announcing the new oil immersed "Type 800" lighting switch. The bulletin tells how industrial demand for a rugged lighting switch which provides safety, dependability, minimum maintenance and positive operation for use in locations where atmospheric conditions are adverse, has been met by this company's engineers with this new switch. These switches, according to the bulletin, are available in 6 and 12 gang single circuit panels of 125–250 volt a-c, 3 wire main. Rowan Controller Company.

(37) Oil Atomization

How to completely dehydrate, degasify, and stabilize oils for transformers, circuit breakers, oil-filled cable, turbines, vacuum pumps, and steel mill bearings is told in a booklet that is available to you. Four separate processes are outlined with a complete description of each process, the sequence of operation, and diagrammatic sketches showing the principles employed. The book tells about the four main enemies of oil, regardless of the type of the oil and regardless of the kind of equipment that it serves. Every steel mill engineer and executive should know about this process. (100). Buckeye Laboratories Corporation.

(38) Goggle Valves

A new booklet is available on mechanical goggle valves for gas washers, precipitators, boiler plants, coke plants, blast furnace gas mains, and many other steel mill uses. This booklet diagrams the various construction features of this mechanical goggle valve which has proven eminently satisfactory and is easily operated in sizes from 6 to 72 in. in diameter and mechanically correct in design. Complete dimensional data is also contained in this bulletin. William M. Bailey Company.

(39) Hoisting Equipment

In a new bulletin the complete line of hoisting and material handling equipment of this company is described. Descriptions include wire and rope clips; blocks and sheaves; hand-powered winches; car pullers; hoists of every conceivable size; derricks; material elevators; cranes; and many other items of this type. Installation photographs, capacity data, and other pertinent information are included. (GC1). American Hoist and Derrick Company.

(40) Speed Reducers

A large catalog on herringbone speed reducers is available to you. The catalog tells how these herringbone reducers are available in a wide range of sizes and capacities. It describes how supply is effected in three general types, namely, single, double and triple, depending on whether one, two or three trains of gears are employed. Included are tables and diagrams showing complete details. Several pages are devoted to installation photographs and descriptions of the installations. The book is clothbound and is prepared so that it stays open to the pages you are studying. (130 pages, 70). W. A. Jones Foundry and Machine Company.

(41) Flanged Pipes

A folder is available containing the most complete engineering data on "Duriron" and "Durichlor" acid-resisting flanged pipes that has been published. The bulletin tells you how useful high-silicon cast-iron pipe is for corrosive solutions; how to install it; and how to avoid misapplication. It lists advantages, limitations, dimensions and available fittings. The bulletin will interest process operators and engineers who must handle corrosives. (704). Duriron Company, Inc.

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Personnel News . . . .

J. Lester Perry, who rose from a steel plant clerk to the presidency of Carnegie-Illinois Steel Corporation, retires August 1 as head of this U. S. Steel subsidiary and becomes assistant to the president, **Benjamin F. Fairless,** of United States Steel Corporation of Delaware. Mr. Perry, a native of Worcester, Massachusetts, began his business career as a cost clerk in the Worcester operations of American Steel and Wire Company on his graduation from high school in 1899, two years before the United States Steel Corporation was formed. He was transferred to the operating end of the industry as a foreman of the cold rolling department in 1913.

From then on he rose rapidly in the Worcester plants of American Steel and Wire Company through the positions of assistant superintendent and superintendent, becoming manager of the company's Worcester district in 1928.

He was appointed vice president of the company in charge of operations in 1933, with headquarters in Cleveland, Ohio. Two years later, Mr. Perry was elevated to the presidency of Tennessee Coal, Iron and Railroad Company, at Birmingham, Alabama, another U. S. Steel subsidiary. On January 1, 1938 he became president of Carnegie-Illinois Steel Corporation, with headquarters in Pittsburgh.

Charles R. Cox became president of Carnegie-Illinois Steel Corporation, succeeding **J. Lester Perry.** Mr. Cox has been president of National Tube Company, another U. S. Steel subsidiary, since March, 1943. Joining the National Tube Company as general superintendent, Ellwood Works, in 1934, Mr. Cox's rise in that company was rapid. In 1936 he was made vice president in charge of operations; in 1941, executive vice president; and in 1943, was elected president of National Tube.

Born in Schenectady, New York in 1891, and educated at New York University, Mr. Cox started his business career in 1914 with Marwick, Mitchell-Peet and Company, chartered accountants, New York. From 1918 to 1920 he was affiliated with the United States Shipping Board Emergency Fleet Corporation. In 1920 he came to Pittsburgh with the Crucible Steel Company of America, and from 1930 to 1934 was associated with Babcock and Wilcox Tube Company, Beaver Falls, Pennsylvania.

John E. Goble was elected president of National Tube Company. Mr. Goble succeeds **Charles R. Cox,** who has become president of Carnegie-Illinois Steel Corporation, another United States Steel subsidiary.

Serving as vice president in charge of sales, National Tube Company, since January 1, 1936, Mr. Goble has been with U. S. Steel and companies now affiliated with U. S. Steel for the last 21 years.

He was born in Margaret, Ford County, Texas, in 1895. After high school and business college training, he became a production worker in oil fields near Petrolia, Clay County, Texas. In 1917 he enlisted in the United States Navy and served until 1919. Following the war he returned to the oil fields of Texas and worked as a driller until 1925 in the famous Burkburnett oil boom in Clay County.

In 1925 he joined the Oil Well Supply Company as South American representative, having his headquarters for four years at Maracaibo, Venezuela, and during this period traveled extensively throughout South America and Europe.

In 1929 he was transferred to the New York office of the Oil Well Supply Company as assistant manager, export division. He was promoted to manager of the division two years later, and remained in this position until he became vice president of National Tube in 1936.

William F. McConnor, general manager of sales of National Tube Company since 1936, has been named vice president in charge of sales of this United States Steel pipe manufacturing subsidiary, it was announced. He succeeds **John E. Goble,** who has just been elected president of the company.

A native of Baltimore, Maryland, Mr. McConnor began his career as an apprentice engineer with the York Manufacturing Company, York, Pennsylvania, in 1914 following his graduation from Lehigh University's engineering school.

He went with National Transit Company at Oil City, Pennsylvania in 1915, as a draftsman and designer on diesel oil and gas engines for pipe lines. Two years later he joined National Tube in the company's Pittsburgh engineering department, where he worked closely with customers on pipe engineering problems. He was named assistant superintendent of construction in building additions to the company's Christy Park Works at McKeesport for increased war production in World War I. After the war, he stayed on at Christy Park as construction engineer, directing the building of new facilities for the manufacture of large diameter welded pipe.

In 1920 Mr. McConnor was made assistant superin-

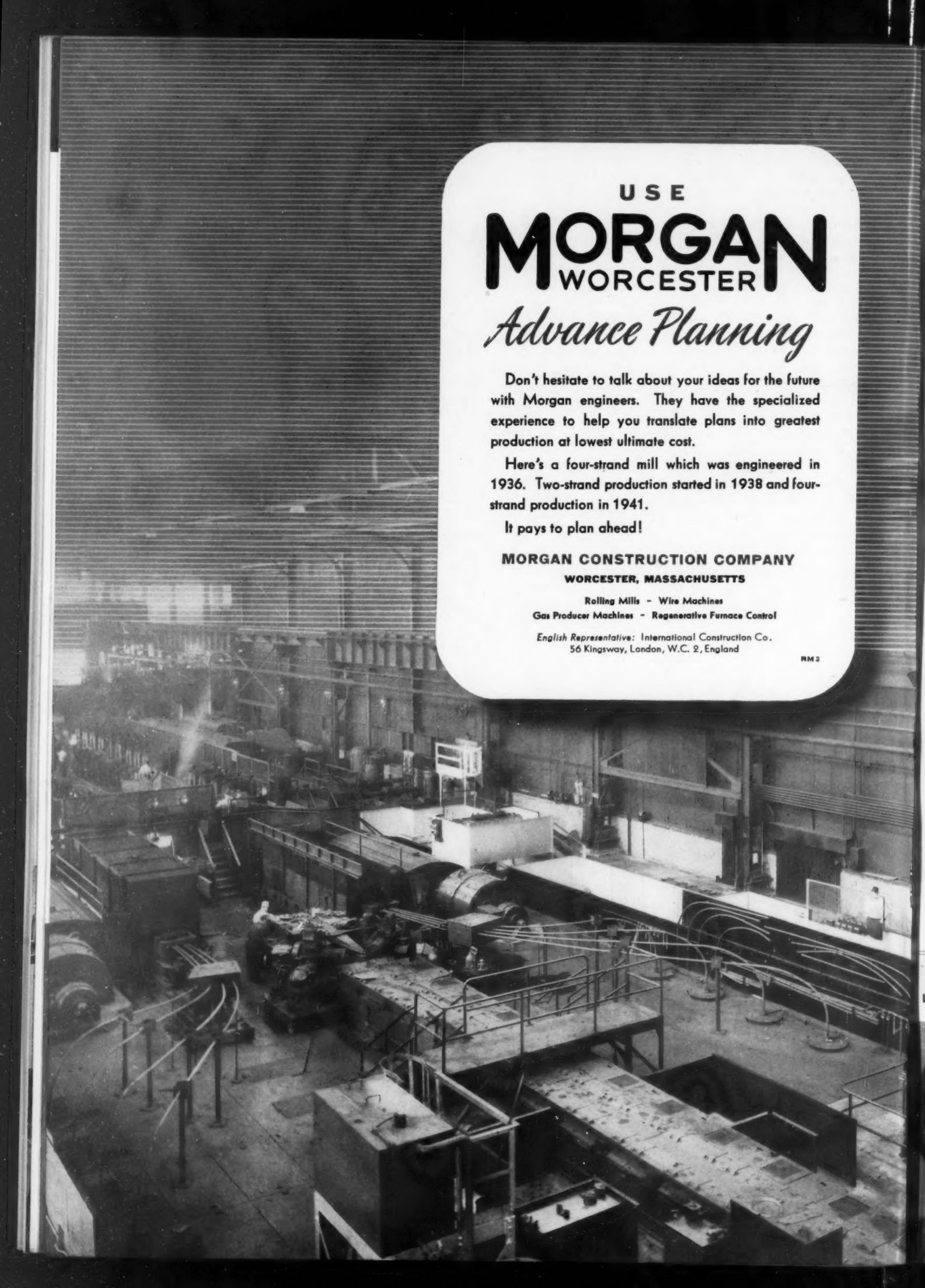
(*Please turn to page 133*)

J. LESTER PERRY

CHARLES R. COX

JOHN E. GOBLE

WILLIAM F. McCONNOR



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RM 3

tendent of the large pipe department at Christy Park, and from 1923 to 1931 he was an assistant to the vice president, operations, on steel distribution and seamless pipe. He was assistant general manager of sales from 1931 to 1936.

Louis H. Derrer was appointed general manager of the steel works at Algoma Steel Corporation, Ltd., Sault Ste. Marie, Canada. Mr. Derrer was graduated from McGill University at Montreal, Canada; Temple University, Philadelphia, Pennsylvania; and Washington University, St. Louis, Missouri. He entered the employ of Algoma Steel Corporation, Ltd., in 1922 in the apprenticeship shops drafting office and later became steam engineer, fuel department. From 1922 to 1926 he was assistant master mechanic, blast furnace department at Alan Wood Steel Company, Swedeland, Pennsylvania. From 1926 to 1935 he was master mechanic and engineer of tests for the Laclede Steel Company at Alton, Illinois. In 1935 he was appointed works manager at Algoma Steel Corporation, Ltd., which position he held until his recent appointment.

Melvin Shaulis has been appointed assistant superintendent of the Brier Hill blooming and round mills of the Youngstown Sheet and Tube Company at Youngstown, Ohio. After working for Newton Steel Company, Mr. Shaulis joined Sheet and Tube in 1933 as a level roller in the Brier Hill sheet mill. In 1934 he was made finishing foreman, became general foreman of the sheet mill in 1939 and in 1942 was made general foreman of the conditioning yard and sheet mill.

John A. Cortelli was appointed chief engineer for the Clark Controller Company at Cleveland, Ohio. Mr. Cortelli was graduated from Case School of Applied Science at Cleveland in 1928 with a bachelor of science degree in electrical engineering. He entered the employ of Clark Controller Company in 1928 in their test, drafting and engineering departments. In 1933 he went with Waite and Bartlett X-Ray Company as a test engineer. In 1934 he returned to Clark Controller as a commercial engineer and later became chief engineer of commercial engineering and held this position until his recent appointment of chief engineer.

Paul M. Christensen has been appointed manager, development engineering department, Clark Controller Company, Cleveland, Ohio. Mr. Christensen was graduated from Trinity College, Hartford, Connecticut with a bachelor of science degree in electrical engineering. In 1926 he went with Colt Patent Fire Arms Manufacturing Company, electrical division, at Hartford, and subsequently became chief engineer. He held this position until his recent appointment with Clark Controller Company.

Louis H. Armstrong has been appointed assistant to the general manager of the Rustless division of the American Rolling Mill Company at Baltimore, Maryland. Mr. Armstrong was also elected assistant secretary of the American Rolling Mill Company.

He was first employed in Rustless in 1936 as a chemist in the copper plating research department. He was promoted to foreman of that department shortly after

(*Please turn to page 136*)

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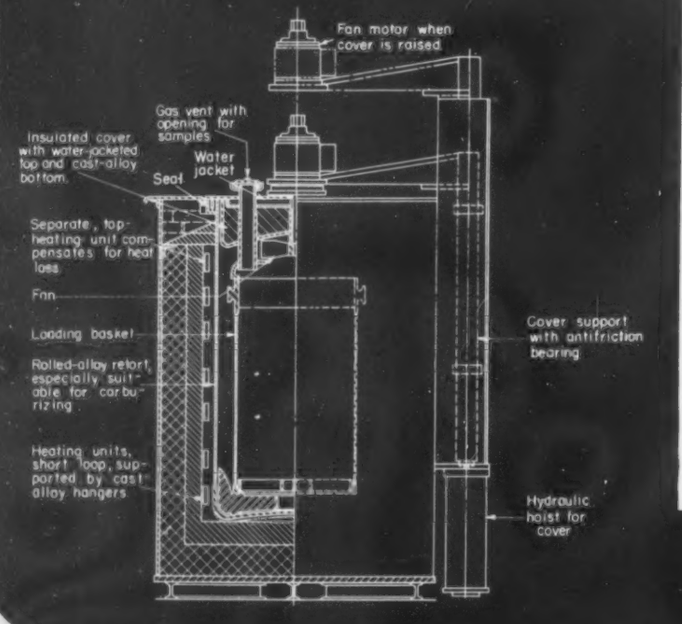
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Seal
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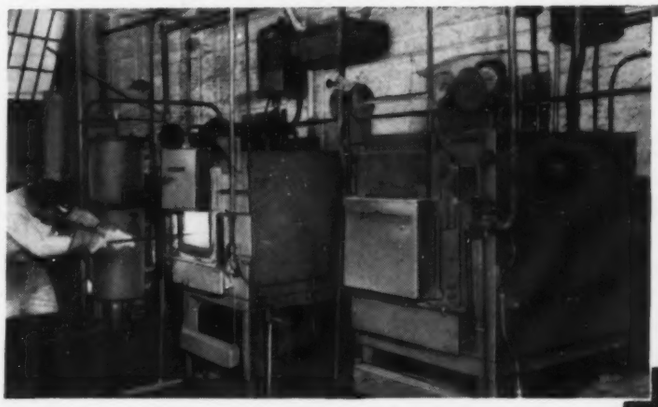

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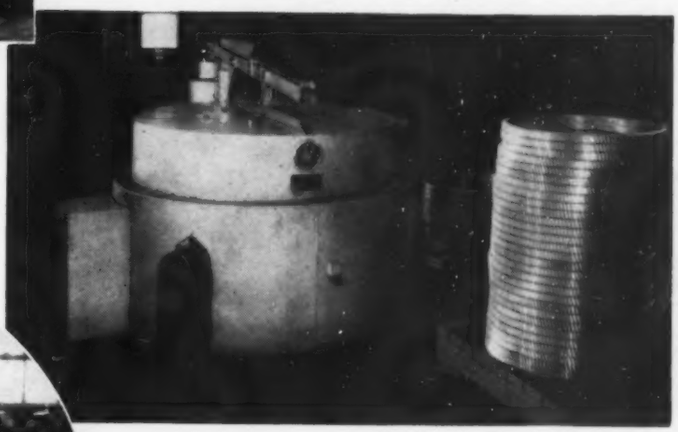

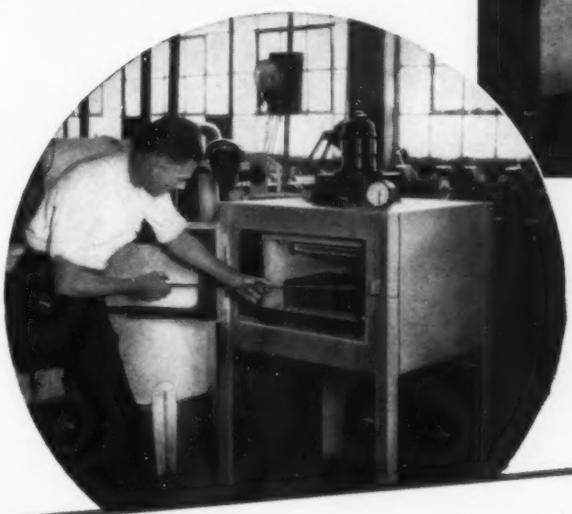

Pit furnace, with protective atmosphere, is used for heat-treating large gears, and for treating tubes and shafts which require suspension in the furnace to prevent warpage. Maximum operating temperature: 1850 F.

Air-draw box furnace—for drawing or tempering tools, dies, and other steel parts requiring accurate drawing temperatures up to 750 F. Standard models are also available up to 1250 F maximum.

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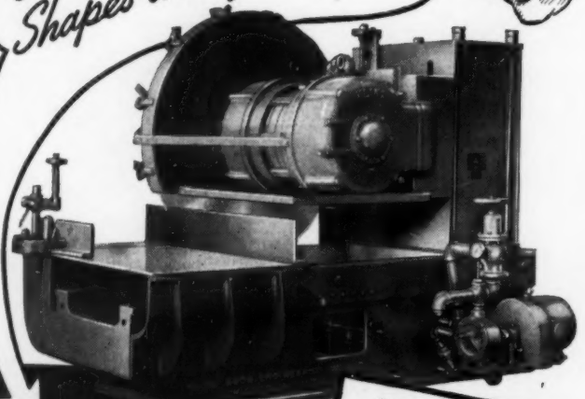

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that date and in 1937, was made turn foreman in the heat treating department. In 1938 he was made general foreman of the pickling department and in 1940, became personnel assistant. The next year he became assistant personnel manager and in 1942, personnel manager of Rustless.

Forrest W. Morrow was recently appointed superintendent of the galvanizing department of the American Rolling Mill Company's east works plant in Middletown, Ohio. He succeeds **D. O. Fisher,** who retired July 15.

Mr. Morrow joined Armco in 1928 as an inspector helper in the company's plant at Ashland, Kentucky. In 1929 he began time study work, which took him to Armco's Hamilton and Middletown, Ohio plants. Handling special assignments in Middletown galvanizing department until 1934, Morrow was advanced to general foreman of that department. In 1945, he was made assistant superintendent of the galvanizing department, which position he has held until this recent appointment.

George E. Reiser has resigned from the board of directors of the Association of Iron and Steel Engineers because he has changed from active to associate classification. Mr. Reiser, who until recently was lubrication engineer for the Lackawanna, New York, plant of the Bethlehem Steel Company, has been appointed sales

GEORGE E. REISER

engineer for the American Car and Foundry Company, New York, New York.

Mr. Reiser was graduated from Buffalo technical high school in 1926 and ventured into the radio repair business. In 1934 he was employed by Bethlehem Steel Company in the electrical department, where he spent five years. He was selected in 1939 to become assistant to C. C. Pecu, lubrication engineer. After serving in this capacity for six years, Mr. Reiser became lubrication engineer upon the death of Mr. Pecu.

Robert W. Ward has been elected a vice president, American Car and Foundry Company, and placed in charge of manufacturing. He has served in various capacities since 1909 when he first entered the company's employ and during the past decade he has served

as district manager of the Huntington, West Virginia, plant.

Mr. Ward was born in Washington, D. C. and later moved to Ashland, Kentucky, attending schools in that city and Ironton, Ohio. He entered the employ of ACF at Huntington immediately upon graduation and served successively as secretary to the district manager, superintendent of stores and yards, superintendent of the car department, and later as general superintendent until 1937 when he became district manager in Huntington.

Roland S. Higgins has joined Hydropress, Inc., New York, as sales representative and head of their Detroit branch office. Mr. Higgins, a mechanical engineer from Armour Institute of Technology, Chicago and Wayne University, Detroit, served in the Naval Reserve in World War I. In World War II he was assigned to the Office of the Chief of Ordnance, Detroit, having the rank of major. After successful practice as designer, engineer and superintendent of construction and operation, he entered the sales engineering field in 1924. For many years he represented such concerns as Pullman Car and Manufacturing Company, Kennedy-Van Saun Engineering Company, Whiting Corporation, Darling Valve and Manufacturing Company, Continental Roll and Steel Foundry Company, etc. Mr. Higgins has opened an office for Hydropress, Inc. at 1608 Industrial Bank Building, Detroit 26, Michigan.

ROLAND S. HIGGINS

Emil Kern was appointed chief engineer for the Allegheny-Ludlum Steel Corporation, with headquarters at Brackenridge, Pennsylvania.

Mr. Kern, 45, was educated in Germany. He came to the United States in 1926 as an exchange engineer, and joined the Mesta Machine Company, where he remained until 1945. Before coming to Allegheny-Ludlum he was with the Reynolds Metals Company as chief mechanical engineer.

John B. Mitchell, formerly assistant to the vice president in charge of manufacturing operations, Jones and Laughlin Steel Corporation, Pittsburgh, Pennsylvania, has been appointed general manager of manufacturing operations, and **Carl C. Henning,** formerly manager of raw materials, has been appointed general manager of raw materials.

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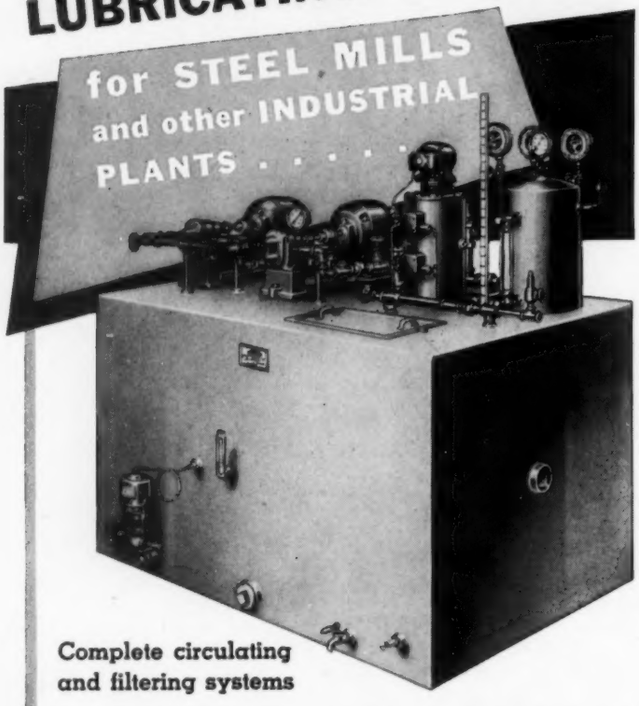
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William Rodder has been made director of engineering for Aetna-Standard Engineering Company, Youngstown, Ohio. Mr. Rodder has been in Aetna-Standard's engineering department for seventeen years, and for the past eight years has been chief engineer.

Perry Snyder succeeds Mr. Rodder as chief engineer. Mr. Snyder was formerly with the Youngstown Sheet and Tube Company, and until recently was division engineer at the Brier Hill works of that concern.

I. H. Lundgren was appointed assistant chief engineer of the Warren district of Republic Steel Corporation. Mr. Lundgren comes to the Warren district from the Central Alloy district of Republic Steel in Canton and Massillon, Ohio, where he has been employed since June 1933 as a draftsman and later as an engineer.

He is a native of Youngstown, Ohio, and received

I. H. LUNDGREN

his education in Youngstown schools and at Carnegie Institute of Technology, graduating in 1933 with a degree in mechanical engineering.

Mr. Lundgren succeeds **H. K. Ihrig** who was recently promoted to the position of chief engineer.

R. E. Wagenhals, formerly quality control engineer, has been appointed director of quality control for all bearing divisions of the Timken Roller Bearing Company. He will coordinate all quality control activities involved in the manufacture of Timken bearings.

Mr. Wagenhals, who began his career at the Timken company in 1943 as a member of the factory engineering staff, was born December 12, 1906, in Mobile, Alabama, and educated there and at Ohio State University, where he received his Bachelor of Industrial Engineering degree in 1932.

Stephen H. Newburn has been appointed manager of Air Reduction Sales Company's Detroit district. A Penn State graduate, Mr. Newburn joined Air Reduction in 1936 as a district representative in Pittsburgh. In 1944 he was made assistant sales manager at Cleveland and was promoted to manager in 1945. Mr. Newburn succeeded **G. J. Dekker** recently elected vice president of The Ohio Chemical and Manufacturing Company, an Air Reduction subsidiary.

Thomas J. Bostwick, chief electrical engineer for the Aluminum Company of America for 22 years, has retired. He will continue as consulting electrical engineer.

Succeeding Mr. Bostwick as chief electrical engineer will be **Donald I. Bohn,** and the latter's position as assistant chief electrical engineer will be filled by **Louis N. Grier.**

A veteran of 46 years' service with the company, Mr. Bostwick has headed a program of electrical engineering design, construction and operation.

Mr. Bohn has been with the company since 1923. Mr. Grier joined Alcoa in 1919.

C. H. Lenhart has been appointed assistant general superintendent of Kaiser Company's iron and steel division at Fontana, California. Prior to this appointment, Mr. Lenhart was superintendent of the blast furnace department.

J. M. Hooper has been appointed assistant general superintendent. Mr. Hooper, prior to this appointment, was superintendent of the rolling mills department.

E. J. Duffy has been promoted from assistant superintendent of the blast furnace department to the position of superintendent of the blast furnace department.

J. E. Macorey has been promoted from the position of assistant superintendent of the rolling mill department to the position of superintendent of the rolling mill department.

C. A. Herbert has been appointed superintendent of the tube mill which is now under construction. Mr. Herbert was formerly with the Salem Engineering Company, Salem, Ohio.

B. A. Shrive has been appointed superintendent of maintenance. Mr. Shrive was formerly associated with the Steel Company of Canada, Ltd. at Hamilton, Ontario.

W. R. Crampton has been appointed superintendent of yards, roads and transportation. Mr. Crampton recently resigned from the Inter-State Commerce Commission, and was formerly employed by the Republic Steel Corporation at Warren, Ohio.

Robert C. Madden has been appointed superintendent of metallurgical inspection and chemical laboratories. Mr. Madden was recently released by the Navy. Previous to his service in the Navy, he was associated with Bethlehem Steel Company.

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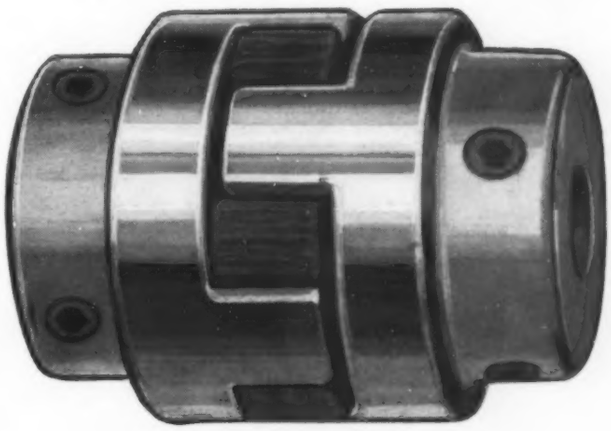

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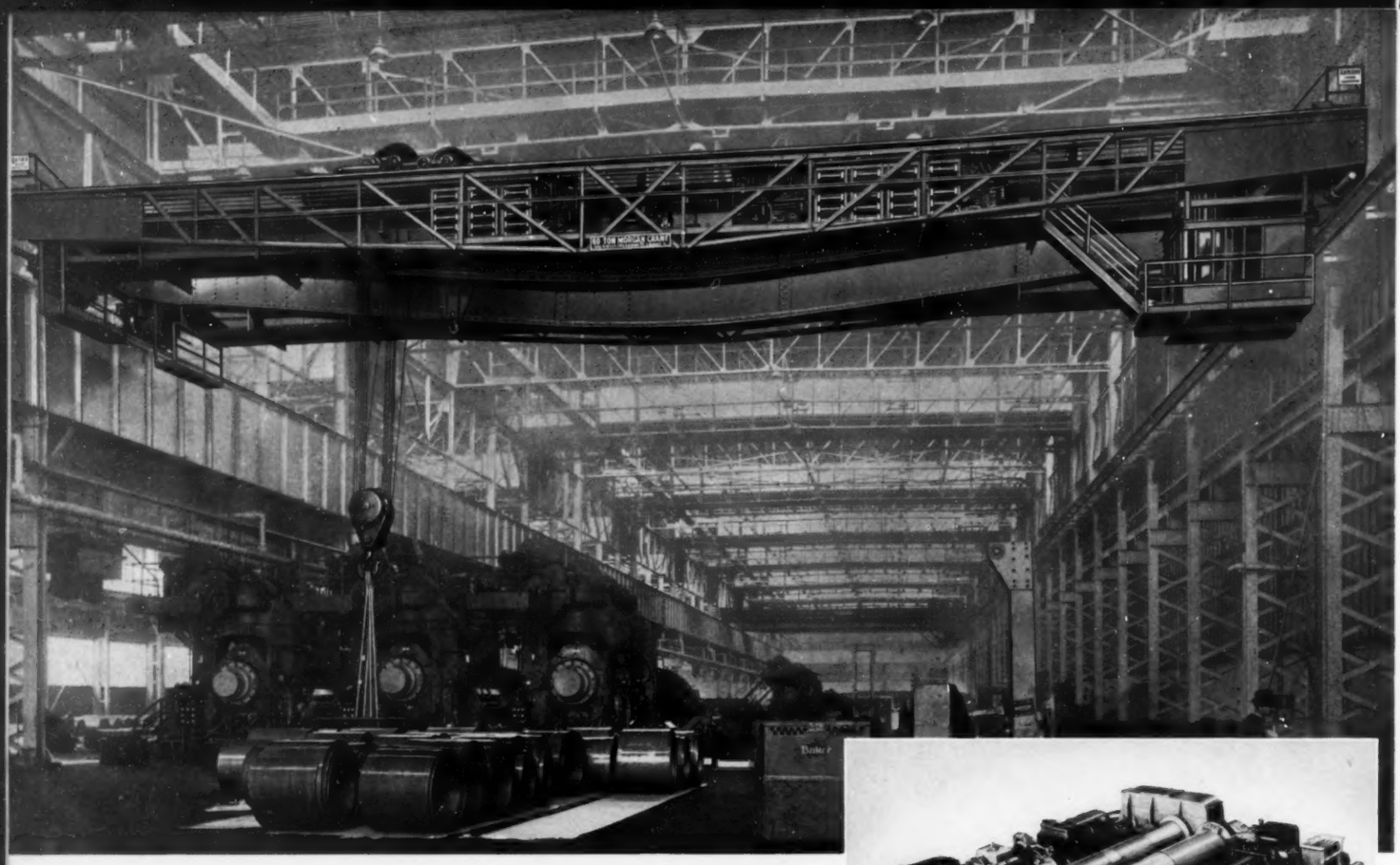

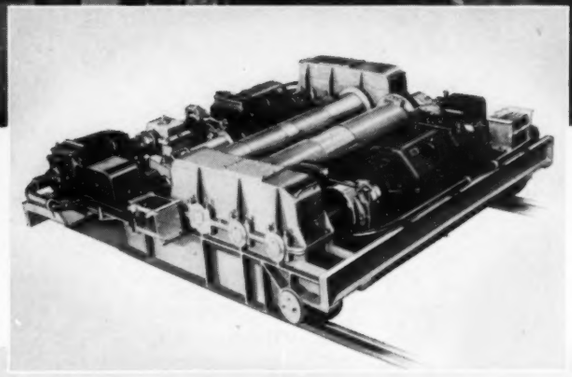

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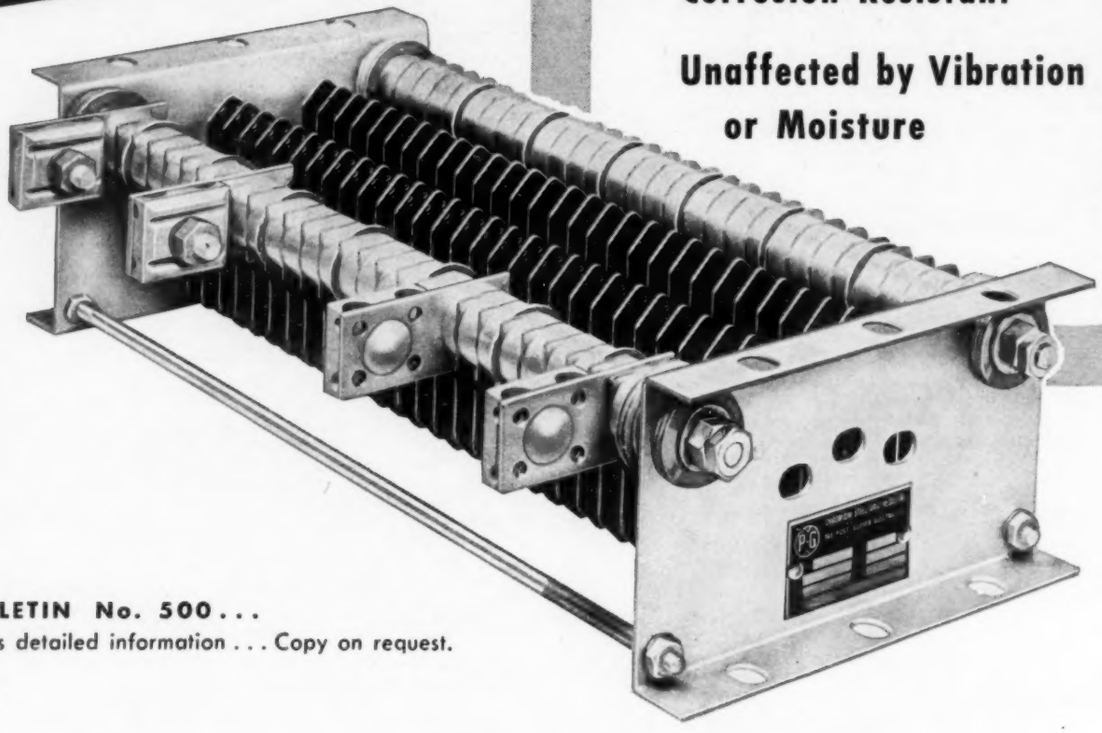

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